WORLD'S POULTRY SCIENCE JOURNAL

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1954

Official Organ of the
WORLD'S POULTRY SCIENCE ASSOCIATION
Volume 10 - Number 2

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WORLD'S POULTRY SCIENCE JOURNAL

Volume 10 April-June Number 2

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TENTH WORLD'S POULTRY CONGRESS
EDINBURGH, SCOTLAND, AUG. 13-21, 1954

The Department of Agriculture for Scotland are happy to report that arrangements for the Congress are proceeding satisfactorily.

Her Royal Highness Princess Alice, Countess of Athlone, has graciously consented to open the Congress on the morning of Saturday, 14th August.

The Right Honorable The Earl of Home, Minister of State for Scotland will receive Congress members on behalf of Her Majesty's Government in Parliament Hall on the evening of the same day. This historic Hall dates back to 1639 and was used for meetings of the Estates until 1707 when the ancient Parliament of Scotland sat for the last time.

An encouraging number of applications for membership has already been received and there seems no doubt that the final membership will exceed those of the two post-war Congresses. The Congress Organizers are particularly anxious that those who have not yet submitted their applications should do so without further delay. This will help greatly with the arrangements for the business of the Congress and for the

PARLIAMENT HOUSE, EDINBURGH

The courtyard of Parliament House. In Parliament Hall, inside, Her Majesty's Government will hold a reception for members of the Tenth World's Poultry Congress.

social functions which are being arranged. Those who cannot attend the Congress but wish to be associated with it should apply for Associate Membership as soon as possible and thus make sure of receiving their copies of the printed Reports of Proceedings.

The final selection of Papers to be presented at the Congress has now been made. Altogether 112 Papers from 23 different countries will be presented at the five sessions which are running concurrently. In addition, as already announced, three Papers will be presented to the Plenary Session by Professor I. M. Lerner, Dr. T. H. Jukes and Mr. J. E. Wilson.

One of the highlights of the entertainments programme will be the Scottish Evening which is to take place in the Congress Club on Wednesday, 18th August. Arrangements which have been made for this event include a Scottish cabaret and demonstrations of Scottish country and Highland dancing in which the visitors may take part. The Congress Organizers have learned that the very full programme already announced is to be supplemented by cocktail parties and dinners to be provided by various trade organizations and national delegations.

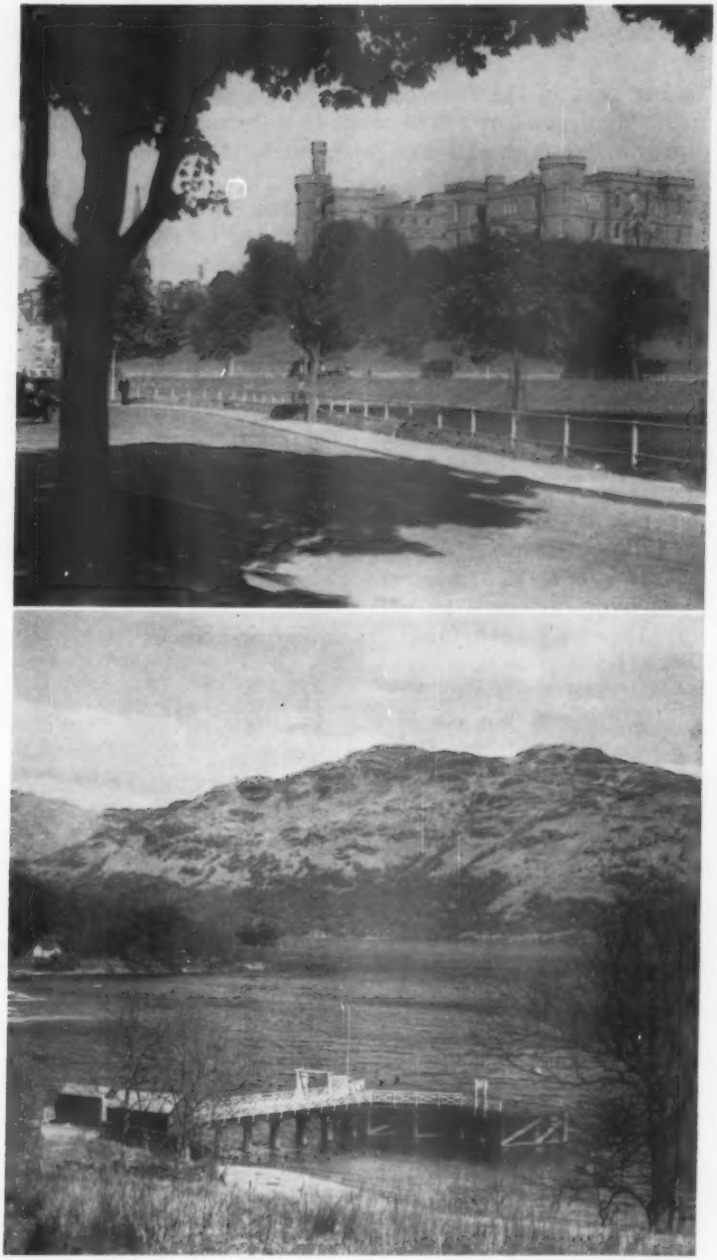
George Square, Glasgow, Scotland

Those who come to Edinburgh in August for the Congress may be assured of a rewarding and enjoyable stay. The Scottish Poultry Industry and the Scottish people are ready to welcome them.

Congress Tours

At World's Poultry Congresses it is customary for visitors to take part in tours of the host country to see not only poultry enterprises but also places of historic and scenic interest. Scotland is particularly fortunate in her natural attractions and the tours which have been planned in connection with the Tenth Congress should be very attractive so that members may have an opportunity of attending the Edinburgh Festival of Music and Drama which takes place immediately after the Congress. Three long tours have been arranged. The Highlands and the north-east are covered by a seven-day tour which commences on 7th August. The party will spend nights in Pitlochry, Aberdeen, Inverness, Fort William and Glasgow. The Town Council of Aberdeen will entertain those taking part to a civic luncheon, and civic receptions are being given by the Town Councils of Inverness, Fort William and Glasgow. In addition to visits to poultry farms, the Tummel-Garry hydro-electric scheme, the Pitlochry Festival Theatre and a distillery are included in the tour.

Aberdeen Harbour, Scotland



Top: Inverness. *Bottom:* Loch Lomond at Tarbet, Scotland.

The Border country and the south-west—the country of Sir Walter Scott and Robert Burns—will be visited by those taking part in the four-day tour which starts on 10th August. The first night will be spent in Kelso and the second and third in Dumfries and Ayr, where civic receptions are being given.

The third tour, which is of three days duration, commences on 11th August. Two nights will be spent in Perth where the Town Council will entertain the tourists to a civic dinner.

On the Sunday, 15th August, three coach excursions have been arranged. The first will visit the Poultry School for Scotland at Auchincruive, traveling through Ayrshire and the Burns country, thus giving members an opportunity of combining a visit of professional interest with a tour of countryside with great historic and literary associations. The second tour will follow the same route as the first but will not call at Auchincruive in order to allow time for a visit to Culzean Castle and for more sight-seeing in the Burns country. The third tour will visit the Trossachs and Loch Lomond.

Direct all communications concerning the Tenth World's Poultry Congress to:

K. M. Davie, Adm. Sec.
Tenth World's Poultry Congress
St. Andrew's House
Edinburgh 1, Scotland

PAPERS TO BE PRESENTED AT THE TENTH WORLD'S POULTRY CONGRESS

SECTION A—GENETICS AND BREEDING

1	The importance of Further Investigations into the Origin of the Domestic Fowl	C. S. Th. van Gink
2	Genetics of Jungle Fowl Plumage Patterns	E. Kimball
3	The Genetics of a Red Laced White Mutant Chicken	E. W. Henderson
4	On the Origin of the Japanese Longtailed Fowls	H. Oana
5	A Group of Plumage Factors in the Muscovy Duck Cairina moschata Domestica L)	A. M. Taibel
6	Some Observations on Spurs in Female Chickens	H. P. Tandon and S. G. Iyer
7	Sélection des Caractères Economiques—Transformation des Mesures Brutes en Ecarts Réduits pour Atténuer l'Incidence des Variations de Milieu	L. P. Cochez and R. Pero

8	Random Sample Testing	S. C. King
9	La Sélection des Caractères Economiques chez la Volaille	P. Merat, J. P. Boyer, and R. Pero
10	New Approaches in Poultry Breeding	J. H. Martin and A. E. Bell
11	On the Inheritance of Sexual Maturity in Single Comb White Leghorns	N. Onishi
12	Inheritance Studies on Egg Weight in the Domestic Fowl	R. Osborne
13	Concerning the Influence of Environment on the Fertility of White Leghorn Cocks (S.C.W.) of Different Origin	F. Weber and H. Lortscher
14	Feather Measurements, Egg Production and Body Weight	A. M. Gericke and J. Erasmus
15	Purebreds, Crossbreds and Incrossbreds for Egg Production in the U.S.A.	R. C. Jaap, J. F. Grimes and T. H. Coleman
16	Hybrid Vigour in Poultry	M. Pease and F. Dudley
17	Testing the Heredity Value of Cocks prior to their use for Breeding	A. Mehner, H. Scherrbacher and J. Harms
18	Seven Years Pedigree Breeding for Egg Production on a Small Scottish Farm	T. Milne
19	Essai d'amélioration des facultés de Fécondation et d'éclosion d'une lignée de pondeuses par le contrôle génétique	M. Ponsignon
20	Heterosis from Crisscross Breeding in Poultry	F. Skaller
21	Influence of Size of Eggs on Growth Rate of Embryos and Chicks	J. Axelsson
22	Black Down Colour and Riboflavin Deficiency in Embryos of the Domestic Fowl	P. E. Bernier and W. T. Cooney
23	Particular Staining Reactions in Fowl Spermatozoa	T. Bonadonna, G. C. Pozzi and L. Olgiati
24	The Relationship between Morphology and Function in Fowl Spermatozoa	P. E. Lake
25	Au Sujet de l'Hybridation dite "Végétative" chez les Volailles	E. Letard and P. Szumowski
26	Studies on the Reproductive Physiology of the Cock: *V*—The Influence of Androgen on the Accessory Organs of the Phallus	H. Nishiyama
27	Precipitation Test for a Generic Hybrid in Poultry	K. Sasaki

SECTION B—PHYSIOLOGY AND NUTRITION

28	The Digestibility of the carbohydrate complex of bran and oats by adult cocks	W. Bolton
29	Growth stimulating effect of lactose in a complete synthetic diet for chicks	G. M. Briggs and M. R. Spivey
30	Some factors to consider in determining the digestibility of poultry feeds	S. Eriksson
31	Experiments with cooked potatoes, potato silage and dried potatoes as feeds for laying pullets	J. Hoie and O. Sandvik
32	Microscopic studies of the gut flora of the hen with special reference to the breakdown of starches	M. J. Masson

33	A study of high levels of cane final molasses in laying rations	M. M. Rosenberg
34	Carobs in poultry nutrition	D. Uri, Z. Ben-Adam, and E. Yizhaki
35	The Protein requirement of Pilgrim goslings	J. R. Aiken, W. G. Hunsaker, A. B. Morrison & H. S. Gutteridge
36	A depressant effect of a white fish meal on hatchability	D. J. G. Black R. C. Jennings T. R. Morris and J. A. Palgrave
37	The evaluation of protein supplements for egg production	K. J. Carpenter
38	The evaluation of leaf protein concentrates in poultry rations	G. M. Ellinger
39	Suitability of cottonseed meal in diets for laying chickens	B. W. Heywang
40	Effect of thyroxine in vitellin production in the fowl	T. Hosoda, T. Kaneko, K. Mogi and T. Abe
41	The effects of feeding cooked fish offals and supplementing with antibiotics on the growth of chicks	K. Kudo and I. Isogai
42	Studies on the serum proteins of the fowl by filter paper electrophoresis	W. P. McKinley W. F. Oliver W. A. Maw and R. H. Common
43	Effect of arginine, glycine, methionine and vitamin B_{12} on chick growth	H. Morimoto S. Ariyoshi and H. Eoshii
44	The UV-light absorption of the proteins of fresh and stored hen eggs	W. Rauch and G. Varela
45	Etude de quelques vitamines du complexe B.2 dans l'oeuf de poule	J. Adrian
46	Nitrogen metabolism in the folic acid-deficient chick studied by a balance technique	W. O. Brown
47	Correlation of microbiological and chick assays for vitamin B_{12}	C. A. Denton, R. J. Lillie and J. R. Sizemore
48	Unidentified chick growth factor in herring meal and solubles	B. Laksesvela
49	The biosynthesis of ^{14}C-B-carotene and its use in metabolic studies with chickens	D. H. Laughland
50	The utilization of the intestinally synthesized riboflavin and vitamin B_{12} by poultry	D. H. Shrimpton
51	Further observations on the feeding of manganese deficient diets to growing and breeding chickens	L. G. Chubb
52	The phosphorus requirements of chickens	W. F. O'Rourke H. R. Bird P. H. Phillips and W. W. Cravens
53	Timing functions of a neural component in the mechanism of release of pituitary gonadotrophin for ovulation in the hen	R. M. Fraps
54	Balance studies with radioactive labelled penicillin (35S-N-ethylpiperidyl-penicillin) administered to laying hens in normal and increased doses	H. Havermann and H. W. Scharpenseel
55	Rhythms of the hourly heat production of hens during the day	H. W. Hohls

56 Development of heat regulation in the chick — C. Romijn
57 Reflex "bearing down" in the hen — A. H. Sykes
58 Observations on the nesting habits of Brown Leghorn hens — D. C. M. Wood-Gush

SECTION C—DISEASES AND THEIR CONTROL

59 Avian Leucosis: A Plea for Clarification — J. G. Campbell
60 Problems concerning Leucosis and its Control — F. B. Hutt and R. K. Cole
61 Avian Lymphomatosis Mortality among Inbred Line Crosses — N. F. Waters
62 The Peroxidases of Avian Leucocytes — F. Polo Jover
63 Feather Pigmentation and Structural Peculiarities in a Strain of Brown Leghorns Exhibiting Symptoms of Visceral Lymphomatosis — Mary Juhn
64 The progress of Pullorum Disease (B.W.D.) Control and Eradication in England and Wales — J. D. Blaxland
65 The Effectiveness of Fumigation with Formaldehyde-Potassium Permanganate and the Influence on the Hatchability — A. Clarenburg and C. Romijn
66 The Influence of Certain Chemico-Physical Characteristics of Formaldehyde on its use as a Disinfectant — E. G. Harry
67 The treatment of fowl typhoid with furazolidone — P. D. Harwood and Dorothy I. Stunz
68 Les Granulomes des Oiseaux — G. Lesbouyries
69 Coligranulomatosis in Poultry — L. M. G. Geurden and A. Devos
70 Pasteurellosis and Pseudotuberculosis in Fowls in Denmark — H. E. Marthedal and Grethe Velling
71 Immunization of chickens against Infectious Bronchitis and Newcastle Disease by the Spray Method — J. F. Crawley
72 The Importance of the Demonstration of Specific antibodies in Dead Birds and of Effective Vaccination in the general control of Fowl Pest — H. Woernle and O. Siegmann
73 La Vaccination Contre L'Affection Diphtéro-Variolique des Oisebeaux et les Vaccinations Associées — J. Verge
74 Variation in the Virus of Infectious Laryngotracheitis and its Epizoological Implications — M. F. Pulsford
75 Chronic Respiratory Disease — E. L. Stubbs, F. G. Sperling and J. R. Leece
76 The identification of infectious coryza associated with Nelson's cocco-bacilliform bodies in fowls in England and its similarity to the chronic respiratory disease of chickens — H. P. Chu
77 Experiments with Chick Encephalomalacia — E. P. Singsen, L. D. Matterson, R. H. Bunnell, Anna Kozeff and E. L. Jungherr
78 Studies on Leg Weakness in Turkeys, Ducks and Geese — Milton L. Scott and G. F. Heuser

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81	Preliminary Observations on the Physical Conditions of Built-up Litter and their Possible Effects on the Parasitic Populations	C. Horton-Smith and P. L. Long
82	L'Action Coccidiostatique du Nitrophénide Chez les Poussins	A. E. R. Willems F. Vanschoubroek and R. Vercruysse
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85	Observations on the Epizootiology of Enterohepatitis (Blackhead) in Turkeys	Jean Stephenson and D. L. Hughes
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91	Production—Line Candling Systems Reduce Egg-Handling Costs	N. G. Paulhus
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93	The "Eat More Turkey" Campaign	M. C. Small
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95	The use of economic analysis in Poultry Farming	N. Westermarck

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99	A Scheme for Controlling Breeding Flocks in Israel	D. Uri
100	Poultry Development in Thailand	L. Suwan
101	Teamwork as a Principle of a new Swiss Poultry Breeding Scheme	D. Wolff
102	Poultry Science for Veterinary Students in South Africa	J. D. W. A. Coles
103	A Preliminary Report on Two Methods for Cooling Laying Hens	S. A. Hart and W. O. Wilson
104	Development of the British Turkey Industry	R. Feltwell
105	Mechanizing the Determination of Quality of Shell Eggs	A. W. Brant and K. H. Norris

106	Studies of the Quality of Shell Eggs with Special Reference to the Problem of Dirty Eggs	N. E. Holmes
107	The Relation of Temperature and Humidity to Infection of Shell Eggs by Bacteria	E. H. McNally
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NETHERLANDS: WORLD'S LARGEST EXPORTER OF FRESH EGGS 1953

In 1953 the Netherlands exported 60 percent of its egg production in the form of fresh eggs and surpassed Denmark to become the world's largest exporter of fresh eggs, according to R. A. Brand, Second Secretary of the Embassy, American Embassy, The Hague. The Netherlands exported 1,644 million fresh eggs in 1953 and 1,398 million in 1952 compared to Denmark's exports of 1,500 million eggs and 1,473 million respectively.

Estimated 1953 production in the Netherlands totaled 2,780 million with commercial delivery of 2,230 million respectively, compared to 2,570 million and 2,200 million during 1952. The relative decrease in sales to the commercial delivery trade as compared to the larger production is partially due to larger direct sales by farmers to consumers and shops. Wholesale prices of eggs declined and closed the 1953 season at approximately 50 cents per dozen. (Foreign Crops and Markets, Foreign Agricultural Service, U.S. Department of Agriculture, Washington, D.C.)

NOTICES OF MEETINGS OF THE WORLD'S POULTRY SCIENCE ASSOCIATION

To All Members of Council

Notice is hereby given that the triennial meeting of the Council will be held at 8 p.m. on 15th August, 1954, in the North British Hotel, Princes Street, Edinburgh. The business of the meeting will be to consider the Report and Balance, to elect Officers and Members of Council for the three years commencing 1st January, 1955, to appoint Members of Council and to deal with any other competent business.

The attention of members is drawn to sections 4 and 5 of Article VI of the Constitution of the Association.

(4) For the election of President, Vice-Presidents, Secretary and Treasurer a three-fifths vote of the Council shall be required, and such election shall be at the Triennial Meetings. Nominations for these offices may be made in writing by any Patron, Affiliation or Member of the Association or by the Council.

(5) One-half of the Members of the Council shall be elected every three years at the Triennial Meetings. Nominations for the Council may be made to the Secretary in writing by any Patron or Affiliated Body or Branch Organization or Member of the Association of the country concerned. If no nominations are received from such Members, nominations may be made by any Member of Council. A majority vote of the Council shall be required for election.

The term of office as Members of Council of the following members terminates on 31st December, 1954.

Australia—Mr. R. W. Kurrle.
Canada—Professor J. R. Cavers, Dr. H. S. Gutteridge.
Denmark—Professor V. Adsersen.
Eire—Mr. D. Philpott.
England—Dr. D. J. G. Back, Dr. R. F. Condon, Mr. E. T. Halnan.
France—Mr. P. Waroquiez.
Germany—Dr. A. von Burgsdorff-Garath.
Holland—Mr. J. G. Tukker.
Italy—Mr. F. Garagnani.
Japan—Two places to be filled.
New Zealand—Mr. J. H. Kissling.
Northern Ireland—Mr. J. G. Rhynehart.
Scotland—Miss M. M. MacLeod.
South Africa—Mr. G. Hibbert.
Sweden—Professor Nils Olsson.

Switzerland—Mr. H. Ebbell, Dr. E. Hess.
Thailand—To be filled.
United States of America—Mr. H. H. Alp, Dr. E. M. Funk, Mr. R. R. Hannas, Dr. O. B. Kent, Mr. M. C. Small.
Mr. R. R. Hannas, Dr. O. B. Kent, Mr. M. C. Small.

Nominations for the vacancies thus created should be forwarded to me by the Countries concerned at least 28 days before the meeting. Nominations for the offices of President, Vice-Presidents, Secretary and Treasurer should be forwarded to me at least 28 days before the meeting.

To All Members of the Association:

Notice is hereby given that the Triennial Meeting of the Association will be held immediately following the termination of the Final Plenary Session which is being held in the McEwan Hall, Edinburgh, on the afternoon of Friday, 20 August, 1954.

Ian Macdougall

UNITED KINGDOM BRANCH OF THE WORLD'S POULTRY SCIENCE ASSOCIATION

The Seventh Annual General Meeting of the Branch was held on March 26, 1954, in London under the Chairmanship of Dr. Rupert Coles, the President. The Report for 1953 reflected an increase of 26 in membership, the total at 31st December being 364. Of that number 296 are in England, 47 in Scotland, 17 in Northern Ireland and 4 in Wales. Two very successful and well-attended Conferences were held during the year. The finances of the Branch continue in a strong and healthy state.

Dr. Coles, who completes his term as President of the Branch declined to accept nomination for a further term of office. Dr. R. F. Gordon was appointed President with Dr. Coles as Vice-President and Chairman of the Executive Committee. Major Ian Macdougall was re-appointed Secretary-Treasurer.

During the year the Branch instituted an Essay Competition the prize for which consists of books to the value of £10. 19/- on Poultry Husbandry and cognate subjects, approved and supplied by the Executive Committee of the Branch. The subject for this year's competition was "Discuss the advantages and disadvantages of the intensive and range systems of poultry keeping." The competition is limited to certain classes of poultry students in the United Kingdom.

TRAINING THE POULTRY ADVISER

THOMAS E. WHITTLE
West of Scotland Agricultural College, Auchincruive, Ayr, Scotland

Scotland is proud of its fine agricultural extension service, run by the three Agricultural Colleges at Aberdeen, Edinburgh and Glasgow. Advice is given to farmers in all branches of agriculture, by a team of expert county advisers. These advisers specialize in agriculture, horticulture, poultry, dairying, machinery, bee keeping, etc., and have access through senior College specialists in Research Institutes, with which Scotland is well provided.

In poultry matters, every county in Scotland has at least one adviser, many have two and larger counties like Aberdeenshire have four. In the 33 counties there are about 40 full-time poultry advisers, which averages one for every 250,000 birds, in a total population of some 10 million head of poultry.

Before entering College service as county poultry advisers applicants must undergo some three to five years training. Most of the advisers are women, who, after leaving school at 16 to 18 with the necessary qualification to enter a training center, spend a period of at least a year on a farm approved by the College authorities. Only the best and most efficiently run farms are selected for practical training, because first-class practical experience is considered an essential basis on which to build the College training. "Mixed" farms, with both cropping and stock interests are preferred. Farm training is, of course, particularly valuable for the city or town-bred student.

A student intending to specialize in poultry husbandry would naturally select a farm for practical training with a large poultry unit with interests in breeding, hatching, rearing, commercial egg production and table poultry production; or she might spend several months on each of two or three specialized farms. With a mind to fuller training, many students still follow the long established practice of taking Diplomas in both dairy husbandry and poultry husbandry, now possible in a three year combined course at College. As a Diploma course requires a student to have at least a year of practical experience on a farm specializing in the subject of the Diploma, some students may spend up to two years on different farms, covering cropping, dairying and poultry husbandry.

Each College provides two year courses which qualify for Scottish Diplomas in Agriculture, Dairy Husbandry, Poultry Husbandry, Dairy Technology, and Horticulture. With the exception of Dairy Technology, these Diploma courses all have a common first year, embracing basic subjects like agriculture, agricultural botany, chemistry, zoology and bacteriology, engineering, surveying, accountancy and applied economics. Second year specialized instruction for Diplomas in some subjects is given at all three Colleges, while in others it is given at one College only. For instance, second year applied instruction in dairying and poultry husbandry is given by the West of Scotland College at Auchincruive, Ayr, where long established schools have specialized in these subjects. A student may therefore take the first year of his Poultry Diploma at any one of the three Colleges, but he proceeds to the Poultry School for Scotland at Auchincruive for his second year. In the final year of their course for the Scottish Diploma in Poultry Husbandry students thus spend four terms at the Poultry School specializing in poultry husbandry in all its branches.

THE POULTRY SCHOOL

As a major center for the whole of Scotland the Poultry School is well equipped and is run on lines that ensure very adequate instruction. Thirty acres of land at the School are exclusively devoted to Poultry, and another 8 acres are available each year on the general farm on a rotational basis. The administrative buildings comprise office and lecture room accommodation, incubator and egg rooms, feed storage and mixing rooms, and a large room well equipped for the plucking, evisceration and packing of table poultry. The brooder house is 120 feet by 25 feet and is equipped both for floor and tier brooding. There is a 90 feet by 25 feet laying battery house with accommodation for over 1,000 layers in single cages of various makes, several large deep litter laying houses and a table chicken or broiler house for up to 700 birds.

Breeding stock is accommodated in some 80 semi-intensive and free range houses of various sizes and suitable for both single male pedigree pens and flock matings. Practically all these houses have two alternate grass runs.

For educational purposes, more breeds are kept at the School than would be advisable on a commercial breeding farm. The two most popular breeds in Britain today are the Rhode Island Red and the Light Sussex, and these therefore comprise the two main breeds at the School, about equal num-

bers being maintained of each. The Rhode Island Red is the most popular breed in Britain because it is hardy and an excellent winter layer, whilst the Light Sussex is a good second; in addition to being a good layer, it has excellent sex-linking and table qualities for crossing. Smaller flocks are kept of an auto-sexing barred type of Brown Leghorn known as the Legbar, and also of both Black and White Leghorns besides a few Cornish, known in Britain as Indian Game. These latter breeds are mainly kept for educational purposes and to provide cockerels for crossing.

The School has a breeding flock of about 1,000, 200 of which are progeny-tested birds of two years old or older, and from them all pure-bred replacement stock is hatched. The remaining 800 are first-year birds; the choice 200 or so are mated experimentally for progeny testing, while about 600 are mated for cross breeding. About 1,500 layers are also kept for commercial egg production in laying cages and in deep litter houses. All pure-bred breeding stock, including birds mated for progeny-testing, are recorded by individual trapnesting throughout their breeding lives, and from these about 5,000 pure-bred chicks are hatched annually, each chick being individually wing tabbed to identify it to dam and sire. On the whole the flock is of high quality, fully accredited under the stock improvement scheme of the Department of Agriculture for Scotland, and a full scale progeny-testing scheme has been under way for the past eight years.

Most of the cross bred chicks are hatched for sale as day-old pullets. This gives students plenty of experience in commercial hatchery work, and the incubator room is well equipped with both large and small machines of a total capacity of over 20,000 eggs. Chickens are reared in floor or tier brooders for the first four weeks, when they are transferred to range in a popular type of weaning house, much developed at Auchincruive, known as the hay box fold brooder. This house is a miniature fold unit, moved on to fresh ground daily to keep clear of disease. The brooder is at one end of the unit and has a wire floor, smooth sides and a layer of hay above the chicks to conserve heat. In these brooders chicks can be put out to range in Scotland at four weeks of age without any artificial heat. The feathering is excellent, no cleaning is required and management is simplicity itself. At eight weeks of age the pullets are transferred to range in about 70 large fold units.

About 600 turkeys, mostly Beltsville Whites, are bred and raised each year, and there are also small flocks of Khaki-Campbell and Aylesbury ducks and Roman and Chinese geese. Table poultry production is maintained at a level of about 200 per week throughout the year, many being eviscerated ready for the table.

How are the students trained? An average day consists of practical poultry management from 8 a.m. to 10 a.m. Lectures on poultry husbandry (in all its branches), building construction, applied chemistry, practical anatomy and pathology and applied economics are given from 10 a.m. to 4 p.m., with a break for lunch. There is a further period of practical work from 4 to 5 p.m. Students also take a share of "shutting in" and week-end duties. As well as straightforward lectures, visual aids such as films and slides are much used and there are many practical demonstrations on blood testing, vaccination, dubbing, caponization, culling, stock selection and many other aspects of poultry management. Full use is made of the educational value of visits to saw-mills, forest nurseries, farms specializing in breeding, rearing or table bird production, hatcheries and research stations. Scottish poultry students are fortunate in having within easy reach four famous research stations, the Rowett Nutritional Institute at Aberdeen, the Hannah Dairy Research Institute (close to Auchincruive), the Ministry of Agriculture Poultry Pathology Laboratory at Lasswade, and last but not least, the Poultry Research Centre for Great Britain, located near Edinburgh, and directed by the noted scientist, Dr. Alan W. Greenwood.

The examinations for the Scottish Diploma in Poultry Husbandry set a high standard, and are similar to the requirements of the National Diploma in Poultry Husbandry and a few Scottish students take the latter as an additional Diploma. Since there is no University degree in poultry husbandry in Britain, these two Diplomas rank as the highest qualifications. Students who have obtained either or both Diplomas have no difficulty whatever in securing good posts in the teaching, advisory, or research fields, as well as in practical poultry work.

POULTRY NUTRITION PROBLEMS IN THE UNITED KINGDOM

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Poultry specialists in different countries have many problems in common in devising feeding systems and formulas for rations that give good results and are at the same time economical. And the results of feeding trials in one country can be of the greatest value elsewhere if correctly interpreted. Nevertheless the solution worked out for a problem in one country may be of little practical value in another. Even recommendations for the levels at which protein and vitamins should be included in rations, drawn up for the conditions and combinations of feedingstuffs available in one country, are not always directly applicable in another.

As described in the previous number of this journal, the last fifteen years have, in Britain, seen severe restriction of imports and special difficulties in the provision of feedingstuffs for the poultry industry. Visitors to the 1954 Congress will see these reflected in current practice and in the research work aimed at finding solutions for the problems that have arisen. During the war-time and post-war period of feed controls the highest priority was given to milk production, and if the pre-war pattern of grain and concentrate feeding of dairy cows had continued unchanged for a higher level of milk production it would have left very little indeed of these feedingstuffs for pigs and poultry. Of the greatest indirect importance for the non-ruminants was the greatly increased use of grass as a crop to be dried and particularly ensiled for dairy production rations. Grass is a crop naturally suited to the mild, moist British climate, but had previously been used mainly as grazing to provide the roughage part of maintenance rations.

PROVISION OF ENERGY

The major cost of any balanced ration comes from the need to supply the birds' requirement of energy. The British climate is not particularly suitable for growing low-fibre cereals, and under pre-war conditions imported maize was the cheapest source of calories. Maize cannot be grown as a grain crop in Britain and wheat only in certain areas. Large quantities of 'offals' are available from the milling of home

and imported wheat, but improved milling techniques, and the generally higher extraction rates of flour have made these less "starchy" than before, and of rather lower energy value for non-ruminant stock. The more fibrous cereals, barley and oats therefore became of more importance as staple energy sources. The potato gives high yields of "starch equivalent" per acre, and has a low fibre content, but it is clear from balance studies that much of the starch in raw potatoes is undigested by poultry. Practical trials show that cooked potatoes are well digested but, with the fuel and labor costs for cooking and special feeding, they are unlikely to have an important place in commercial systems except under emergency conditions. On the other hand, results with barley and oats as the staple energy sources in rations have exceeded British expectations—although, with hindsight, the results could have been predicted from the results of earlier Canadian evaluations of these cereals for both poultry and pigs.

It has, however, been a disappointment to many poultry keepers to find that their birds eat so much more of these rations than the standard "4 ounces" quoted from the American literature. This has sometimes been attributed to breeding without attention to the factor of feed conversion efficiency, to the rations not being properly balanced, or to the intensively kept birds eating more than they really require out of boredom. In fact the higher average consumption here, as compared with that in intensive systems in parts of the United States, seems entirely explained by the lower metabolizable energy content of our rations, and our use generally of heavier birds, with greater requirements for 'maintenance.' Undoubtedly the heavier birds give a very worthwhile carcass if killed after only one laying year, but even so with high feed prices, there will probably be an increased demand in Britain for strains of light birds with good viability under intensive methods of management.

It seems that these "home grown" rations do not necessarily give results inferior to those obtained with rations of higher energy content, apart from the feed consumption being greater. Now that a wider range of cereals is becoming available it is important that buyers should be able to make their decisions on the prices to offer for different materials now available, with the best possible knowledge of their relative energy values. For mixed feeds there is an obvious need for improved methods of chemical analysis for predicting the energy value of materials from the results of laboratory tests,

and work is in progress on this problem at two centers. The relation between "metabolizable" and "productive" energy is also being re-examined.

SHORTAGE OF PROTEIN CONCENTRATES

It has long been known that mixtures of barley, oats and wheat, mixed with wheat offals, with the addition of minerals, need little or no further supplementation for laying birds kept out on grass, and recent work has shown that even the wheat offals can be omitted under some conditions. However, although the high-quality of pasture in Britain led naturally to the pre-war poultry industry being built up largely with extensive and semi-extensive management methods, recent costing surveys have all indicated the advantages in the use of winter lighting and in labor-saving in more compact, intensive units; and recent expansion has been largely with intensive units where feed requirements are more critical.

The first requirement in these intensive rations is for supplementary protein and the huge increase in intensive poultry husbandry in the United States has been made possible by the increased acreage given over to the soya bean as a source of oil and protein. Our climate prevents us from doing the same. It is possible to grow beans and peas, but they are lower in protein, and unsatisfactory in other ways also. In view of the successful developments in the use of grass for other classes of stock, and its high yield of protein per acre, many attempts have been made to develop an economic method of processing it so as to separate a high protein, low fibre fraction suitable for non-ruminant feeding. There has been both industrial and government support for work on the subject, but unexpected difficulties have been encountered, and it is not yet certain that suitable fractions can be produced at an economic price.

The most important way of keeping imports to a minimum remains therefore the more efficient use of the wastes and by-products already available and, of these, the fishing industry is the most important source. It has not, as on the Pacific Coast of North America and on the Norwegian coast, been possible to develop "fishing for fish meal" at an economic price, but the use of filleting offals and surpluses from the markets allows an annual production of about 80,000 tons of fish meal in the United Kingdom. Processing methods have been adopted with a view of minimizing nutritional damage, and all the methods currently used give meals of high quality. There is still some wastage, mostly of herring, at ports outside

the economic collection area of a conventional fish meal factory, and when a factory is overwhelmed with large gluts. Lines of attack on this problem, and the possible use of non-toxic preservatives for storing this waste were discussed by Dr. John Duckworth in the previous number of this journal.

Several different oil seeds are imported in considerable quantities in any case for their oil content, and the success of American work on the "improvement" of soyabean meal by suitable heat treatment has stimulated interest in the possible improvement of other meals available here. Groundnut meals show the value that can be expected from their amino acid composition, but sunflower and cottonseed meals offer more scope for improvement.

The second approach lies in cutting down the "margin of safety" in protein content of recommended rations, and some savings have been made here. One difficulty, particularly with farmers using their own grain, comes from the considerable variation in protein content of British cereal crops. Rations can only be constructed with safety by making the supplementary protein sufficient to balance the lowest protein level likely to be encountered. This source of wastage of protein could be overcome by giving "free choice" of grain and a high protein mixture if it were certain that the hens would take only the protein that they needed. Extensive trials of the system in England have given good egg production in some cases, but the hens have balanced their intake at an uneconomically high level of protein.

NEW SOURCES OF VITAMINS

As in the United States, the deflection of milk by-products from animal feeding during the war made it necessary for special steps to be taken to ensure that an adequate level of riboflavin was maintained in rations for chicks and breeding birds. Distillery and fermentation products were not available in sufficient quantities, and special studies were made, particularly in Northern Ireland, of grass meal as a source of riboflavin—in addition to its value as a source of carotene and of pigments useful for maintaining yolk color in battery birds. Now, of course, deficiencies can be made good with cheap, synthetic riboflavin.

The general shortage of protein concentrates in Britain led also to a wide interest in the American investigations of vitamin B_{12} as a factor in poultry feeding, and the use of rich sources of vitamin B_{12}, such as condensed fish solubles and fermentation residues, as supplements in practical rations.

Under British conditions, however, with a larger proportion of the available protein coming from animal sources, and with the predominance of the hen laying table eggs, whose vitamin B_{12} requirement is at any rate very low, these materials have proved of much less value. The new knowledge, and the methods of assay for vitamin B_{12}, have, on the other hand, allowed a closer control of the quality of animal by-products. Even though present-day British rations may not be better than the best of 15 years ago, research has allowed greater flexibility in their formulation, so that high prices of one material can be more successfully evaded by the use of alternatives.

NOTES ON THE POULTRY RESEARCH CENTRE FLOCK OF BROWN LEGHORNS

J. S. S. BLYTH

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Inbred lines have proved to be a fruitful source of new genetical knowledge in both animal and vegetable kingdoms. In poultry, the inbred flock has been, and is being used by many workers to study the effects of inbreeding and incrossing on production traits. The flock of Brown Leghorns, maintained at the Poultry Research Centre, consists of eight inbred lines, but some unusual features in its formation and development may have had consequences different from these obtaining in other inbred flocks formed in a more orthodox manner. An appreciation of these differences is essential in examining the performance of the flock, for an important, and sometimes forgotten, consideration in comparing results from superficially similar sets of material is the question of how far they are directly comparable, and how far complementary.

As was indicated in an article in the previous number of this journal, the flock was founded by Dr. A. W. Greenwood

at the adjacent Institute of Animal Genetics, and has been kept as a closed unit for over 20 years. The small number of birds from which it originated derived from widely different sources, three in England, one in Scotland, and one in Denmark. Before separation into isolates, the stock was interbred in such a way that, with one exception, all the lines trace back to representatives from all five sources; in the exceptional group (N), one foundation sire is missing.

The lines were originally formed in an attempt to fix separately a few of the more outstanding phenotypes that had appeared. The first four to be segregated were large egg size (L), small egg size (S), intensity of production (I), and non-moult (N) (that is, persistency of production between the first and second annual laying cycles, a trait only fully expressed in the early stages of the group's development; it soon became reduced to the exhibition of a shortened annual rest). In each case the line was formed by contributions from a hen showing the relevant trait, and her immediate relatives and progeny. From the remainder of the flock a control line (B) was established in which there has been selection for both egg numbers and egg size. Between the yars 1935 and 1939, three further lines were formed in which the criteria of selection were not directly associated with any egg production trait. Two, dwarf body size (D), and excess of red in the plumage (R), were derived from various crosses of the existing groups. The third, a simple autosomal recessive mutation, white speckling in the plumage (W), is an offshoot of the N line.

Apart from the initial matings, the degree of inbreeding to which the various lines have been subjected is largely incidental to the amount of pen space allotted to each and, in one of two cases, to lowered reproductive fitness. This has resulted in mean coefficients of inbreeding (as estimated by Wright's method) varying from 25 per cent in line B to nearly 80 per cent in S and W. Thus in contrast to the more usual practice of inbreeding closely, with or without some selection of production traits, the increase in consanguinity in this flock has proceeded less rapidly, and each constituent line has been subjected to some differently directed selection pressure; in some lines the pressure has been on a component of production, in others not, a procedure which might be expected to yield widely diversified samples of the flock's original gene complement.

In outward appearance the birds of each line have attained a noticeable degree of uniformity, and there are now marked differences between the lines in conformation and other visible details. There has been considerable segregation, too, in production traits, as is indicatd in the accompanying table, in which the means of groups are listed in order of annual egg production.

PULLETS HATCHED 1952

Line	Annual Egg Production (Survivors)	Inbreeding %	Sexual Maturity days	March Body wt. lb.	March Egg wt. oz.
I	214	44	200	3.6	1.7
B	197	25	183	4.6	2.2
N	193	44	225	3.7	1.8
L	162	58	241	4.4	2.3
R	159	64	217	2.7	1.6
W	153	76	220	3.7	1.9
S	133	77	234	3.3	1.8
D	123	54	183	2.8	1.7

The two most inbred lines, S. and W, are among the worst producers but the two earliest maturing ones are at opposite ends of the list. Body weight and egg size show a tendency to vary together but the association is not perfect as can be seen by comparing lines B and L, or S and I. The smallest egg size does not occur in the line specially selected for that trait. There is no evidence of the known inverse relation between egg size and rate of production; while this may be partly due to the large differences in body size, unequal amounts of pausing in the different lines have also contributed to the result. Even the nature of pausing shows characteristic differences, the pullets from some lines laying poorly in their first autumn, others doing well then but unable to maintain their output in the second half of their production year. Differences in the level of mortality and rearability also occur, and surprisingly it is the least inbred line, B, which has the highest adult death rate. Apart from coccidiosis, there has been no outbreak of infectious disease in the flock; the major causes of loss are reproductive disorders and nephritis. All the lines which were initiated have survived, a point which may be related to the relatively moderate rate at which inbreeding has proceeded; lines R, S, W, and D, however, are now exhibiting inferior viability during incubation and/or rearing, but again there are characteristic variations among them in regard to the stage of development affected.

A striking feature in the history of the flock has been the behaviour of body weight which, except for the D line, was under no conscious selection until after the war; a more or less regular decrease in size occurred in all the lines, being greatest in B and least in L, and was assumed to be a result of inbreeding. Since 1948, however, some attention has been given to improving size with the remarkable result that apart from R, D, and S, the lines have practically regained their original level for the character.

An interesting effect of wartime conditions was brought to light in a study of the B line. Deficiencies in diet and the absence of evening lighting in winter had combined to lower the actual annual egg production. Nevertheless, estimates of the inherent rate of production showed that it had been responding to selection, and had continued to increase though unable to express itself in added egg numbers because of the poorer environment prevailing at this time.

One of the projects at the Center is to examine the performance of crosses between the various groups, and a few intermatings have been made. The incrosses have all exhibited increased viability. Among the small lines, R, S, and D, there was a slight improvement in egg size and body weight over both parent lines; where lines differing in size were crossed these characters were intermediate in the progeny. All the crosses made so far have shown marked heterotic effects in regard to egg production, but in those analyzed, this appears to have resulted from a decrease in pausing rather than in an improvement in basic rate of production over the better parental line. Not all types of pausing are equally reduced however, and Dr. Greenwood has an experiment in progress at present in which a high tendency to winter pausing, typifying one of these crosses, has been completely obliterated by maintaining the birds in a constant environment.

The many characters and traits in which the various lines differ or resemble one another not only present challenging problems to the geneticist but provide both unusually constant and diverse material for work on nutrition, endocrinology, and other branches of poultry science represented at the Poultry Research Centre.

DISTINGUISHED SERVICE AWARDS—UNITED KINGDOM, 1954

Poultry Association of Great Britain makes each year Distinguished Service Awards up to three in number.

The Awards are made to those who, in the opinion of the Council of the Association, have given distinguished service meriting the Award in or to the poultry industry over a long period of years. The Award consists of a handsome bronze medal and parchment citing the Award.

The General Secretary (Mr. John R. Harvey) of the Association states that among the three recipients of the 1954 Awards is Dr. A. W. Greenwood, D.Sc., F.R.S.E., Director of the Poultry Research Centre, Edinburgh, for distinguished services over a long period of years in the field of poultry research work.

Dr. Alan W. Greenwood, D.Sc., F.R.S.E., was born (1897) in Melbourne, Australia. Educated at Wesley College and the University of Melbourne. Graduating with a Bachelor's Degree in 1921, after his studies had been interrupted by some 3 years service with the Australian Imperial Forces, during the first World War, he then specialized in Biology and took his Master's Degree with First Class Honors. A Natural History Prizeman he was awarded a traveling Fellowship by the University and proceeded to Edinburgh for Post Graduate Study under Dr. Crew, who in 1928 became first Professor of Animal Genetics in the University of Edinburgh and Head of the Institute of Animal Genetics. Gaining a Ph.D. in 1925, and a D.Sc. (Melb.) in 1931 he was appointed to the staff of the Institute of Animal Genetics in 1928 and remained a member of that organization until he became Director of the newly established Poultry Research Centre of the Agricultural Research Council in 1947, and was then appointed by the University Court a Research Fellow. His connection with the University of Edinburgh was not severed as it provided the land, adjacent to its science departments, on which the Centre is built.

In the absence of Professor Crew on War Service (1939-45) he was Acting Director of the Institute of Animal Genetics.

His research career has been almost entirely devoted to investigations on the domestic fowl and he was awarded the Keith Prize of the Royal Society for his publications on the Biology of the Fowl.

Awarded a Rockefeller Fellowship in 1931 this study period was spent with Professor Dunn at the University of Columbia, New York and the late Professor Frank Lillie at the University of Chicago.

He visited North America again in 1946 as a member of a British Mission to investigate the development of the poultry industry in Canada and the United States. He is a member of many learned societies both in Great Britain and North America:

Fellow and Past Vice President of the Royal Society of Edinburgh.
Past Vice President of the World's Poultry Science Association.
President of the British Branch of the World's Poultry Science Association.
Fellow of the American Association for the Advancement of Science.
Member of the Poultry Science Association of America.
Member of the Society for Experimental Biology and Medicine—America.
Member of the American Society of Zoology.
Member of the Endocrinological Society—Britain.
Member of the Society for Experimental Biology—Britain.
Member of the Genetical Society.

He is the author of an extensive series of publications in Scientific Journals both at home and abroad. In addition many articles have been published in the press on his investigations at Edinburgh.

"WHICH WAS FIRST, THE HEN OR THE EGG?"

It might be a puzzle to most of the people, but the answer is not so difficult!

With a single hen, you only need a cock to have more eggs and more chicken.

While with a single egg, a cock alone is not enough! There must be a hen to get more eggs and more chicken.

In either case, the existence of the hen is essential, and more important than the egg!

That proves, the hen existed before the egg.

Bengazi, Cyrenaica, Libya
MANSOUR K. SACA,

WORLD EGG PRODUCTION IN 1953; CURRENT CHICKEN NUMBERS*

Egg production in the reporting countries of the world continued its upward trend in 1953 for the second successive year and output in 1953 was only moderately above the postwar peak of 1950. During 1951 production suffered temporarily from the effects of the previous year's record supplies and lower egg prices. Recorded world production in 1953 totaled approximately 134 billion eggs. More than 80 percent of the recorded world output of eggs in 1953 were produced in North America and Europe. Producers began to increase egg production in 1952 and continued the expansion through 1953. Present indications point to expanded output in 1954. In 1952 the egg-feed price relationship improved and became more favorable in 1953 as feed prices declined further. This trend is expected to continue in 1954.

Chicken numbers of the reporting countries in 1953 changed slightly. However, for the second successive year numbers expanded in *Denmark* and the *Netherlands* and more noticeably in the *Philippines* and *Japan*. Even with the increase Japan's numbers are still well below the 1934-38 average but chicken production is expanding according to the livestock program for doubling farm animals from 1950 to 1960. Numbers in the other 3 countries are well above prewar. In the *United States, Ireland, Sweden* and *Yugoslavia* numbers are now higher than a year ago, but are down slightly in the *United Kingdom*.

WORLD EGG AND CHICKEN NUMBERS[1] 1934-38 AND 1946-50 AVERAGES, ANNUAL 1951-53

Commodity	Unit	Average 1934-38	Average 1946-50	1951	1952	1953
Eggs	Millions	78,651	93,724	109,483	112,111	115,665
Chickens	Thousands	763,731	749,500	757,663	791,542	826,393

[1] This does not represent all of the recorded countries, but only those showing data for each year or average in the tables following.

* This is one of a series of regularly scheduled reports on world agricultural production approved by the Foreign Agricultural Service Committee on Foreign Crop and Livestock Statistics. It is based in part upon U.S. Foreign Service reports. Foreign Agriculture Circular FPE2-54, April 21, 1954, United States Department of Agriculture, Foreign Agricultural Service, Washington, D.C.

Western European countries on the whole and many other countries continued a trend of greater consumption of red meat with poultry meat losing ground partly because red meat supplies were more plentiful in 1953 and the price ratio was more favorable.

A number of significant changes occurred in 1953 to effect the world egg situation particularly in the *United Kingdom* and its main supplying countries of Ireland, Denmark and the Netherlands. The slight production drop in the United Kingdom was partly a result of uncertainty accompanying the decontrol of the egg trade in March 1953 after 14 years of stringent control including rationing of commercial feed which was decontrolled in August. Since September egg production and consumption has increased as the consumer for the first time in years has been able to purchase poultry products freely. Too, there seem to be adequate supplies of feed on the free market at reduced prices. These factors combined with a fixed support price for chickens has tended to stimulate production. As of January 1, 1954 United Kingdom contracts for eggs and poultry products with countries in the Sterling Area, primarily Ireland and the Union of South Africa, were terminated. Poultry and egg imports are now handled by private firms. The United Kingdom is the largest importer of eggs in the world.

The indicated production of poultry and eggs for *Ireland* in 1954 is about the same as in 1953. This forecast is based primarily on anticipated reduced feed costs allowing continued exports to the United Kingdom at competitive prices. The United Kingdom has been Ireland's natural export market for its surplus production. For example in 1953 Ireland exported to the United Kingdom some 228 million eggs or 23 percent of its total production. However, the British egg market was over-supplied in late 1953 and competition is increasing in 1954.

Egg production in *Denmark* and the *Netherlands* has risen steadiy in the past few years. In 1953 the Netherlands had a big export year shipping 60 percent of its egg production in the form of shell eggs. Because of ample feed supplies and increased chicken numbers, egg production is likely to increase again in both countries. However, production of these 2 countries could decrease sharply if exports to the United Kingdom are drastically reduced.

CHICKENS

Numbers in specified countries, averages 1934-38, 1946-50; annual 1951-1953, preliminary 1954

Continent and Country	Date Applicable[1]	Average 1934-38	Average 1946-50	1951	1952	1953	1954
		Thousands	Thousands	Thousands	Thousands	Thousands	Thousands
North America							
Canada	Dec. 1	44,077	45,245	34,277	42,717	38,500	—
United States	Jan. 1	408,177	465,503	442,657	449,925	429,731	439,271
Mexico	March	[2]36,368	—	—	—	—	—
Cuba	July	—	9,400	8,500	—	—	—
Dom. Republic	June 30	2,358	[3]1,952	1,854	—	—	—
Panama		[4]195	[4]1,425	1,400	—	—	—
Europe							
Austria	Dec. 3	[4]8,862	5,640	7,700	8,200	8,600	—
Belgium	Dec. 31	16,500	14,069	16,500	15,000	15,000	—
Denmark	July	[4]27,643	22,030	22,250	23,411	24,251	—
Finland[5]	Sept. 1	2,853	2,036	2,880	—	—	—
France	Fall	[6]145,000	—	[7]75,000	[7]70,000	—	—
Germany (West.)	Dec.	51,225	—	48,064	50,676	51,246	—
Greece[8]	Nov. 30	11,679	8,366	8,991	10,010	10,500	11,500
Ireland	June	15,961	16,677	15,951	16,287	16,195	16,225
Italy	Dec.	76,000	—	—	—	70,000	—
Luxembourg	Dec.	[4]515	361	—	403	—	—
Netherlands	Dec.	[8]29,632	7,864	15,676	15,816	15,709	—
Norway	June 20	5,686	4,617	4,689	—	4,887	—
Portugal	Dec. 31	[9]5,716	—	—	12,500	—	—
Sweden	[10]	10,980	12,467	11,766	11,091	10,960	11,050
Switzerland	April	[9]5,544	5,674	6,238	6,260	6,200	—
U. Kingdom—Farm	June	73,402	77,153	90,067	90,422	88,121	—
Yugoslavia	Jan.	18,021	17,043	14,980	18,340	17,030	17,700
Asia							
Lebanon	Dec.	—	1,167	—	—	—	—
Syria		1,525	2,204	2,482	—	—	—
Turkey		16,794	18,811	20,700	21,700	21,320	—
China	[11]	265,765	[4]194,550	—	—	—	—
Japan	July	51,094	17,192	21,845	30,273	36,586	—
India		—	—	62,200	65,600	—	—
Phil. Republic	Dec. 31	25,365	15,766	28,055	32,090	36,444	38,000
Pakistan	Dec. 31	—	[3]38,718	—	58,000	—	—
South America							
Argentina	June	[12]42,988	—	—	60,000	—	—
Brazil		[12]59,000	—	60,970	61,500	—	—
Chile [13]	June	[4]1,026	5,100	—	—	—	—
Paraguay	[11]	—	2,200	—	3,120	3,000	—
Peru		—	—	9,500	—	—	—
Uruguay	[14]	4,814	4,475	—	—	—	—
Africa							
Egypt	July	[9]15,767	16,312	—	—	—	—
French Morocco		[4]50,000	—	—	—	—	—
U. South Africa[5]	Aug.	14,000	15,720	16,000	—	—	—
Fr. West Africa	[11]	—	—	—	—	12,000	—
Oceania							
Australia	Dec. 31	15,541	—	—	—	—	—
New Zealand	March	[9]3,489	—	4,630	—	—	—

[1] Year end estimates (October-December) shown under following year for comparison. Thus for Canada, the December 1, 1952 estimate is shown under 1953. [2] 1940. [3] All poultry. [4] Average 2-4 years only. [5] Adult poultry. [6] Represents chickens raised. [7] Laying hens. [8] June. [9] 1936. [10] Sept. 1937, June 1946-1949, April 1950-52, census estimates include layers and chicks. [11] Month of estimate not available. [12] 1937. [13] Hens and pullets. [14] August.

EGGS

Number produced[1] in specified countries, averages 1934-38, 1946-50; annual 1951-1953, preliminary 1954

Continent and Country	Average 1934-38	Average 1946-50	1951	1952	1953	1954
	Million	Million	Million	Million	Million	Million
North America						
Canada—Farm	2,638	4,015	3,611	3,984	4,086	4,100
Total	2,863	4,382	3,954	4,104	4,200	4,285
United States—Farm	35,498	56,535	59,265	60,985	61,704	64,260
Cuba	320	300	320	—	—	—
Dominican Republic	—	60	60	—	—	—
Panama	—	[2]53	55	—	—	—
Mexico	—	—	—	—	2,080	2,160
Europe						
Austria	663	369	640	785	845	—
Belgium	1,693	1,584	1,945	2,030	2,175	2,225
Denmark	1,979	1,447	1,962	1,968	2,155	—
Finland	317	194	317	—	—	—
France	6,200	6,580	7,500	7,000	8,000	—
Germany, Western	3,700	2,655	5,000	5,300	5,500	—
Greece	550	388	440	490	525	—
Ireland	1,086	893	951	972	980	—
Italy	5,500	4,380	5,500	5,550	5,600	—
Luxembourg	40	[3]36	—	34	35	—
Netherlands	1,978	1,189	2,075	2,570	2,780	2,810
Norway	369	283	391	392	420	411
Spain	1,700	[3]1,878	—	—	1,920	—
Sweden	1,000	1,288	1,390	1,370	1,375	1,400
Switzerland	423	486	529	518	520	—
United Kingdom:						
Farm[4]	[2]3,871	2,880	4,800	4,700	4,600	—
Total[4]	[2]5,098	4,590	6,500	6,300	6,200	—
Yugoslavia	1,000	—	1,006	945	910	—
Asia						
Lebanon	—	52	55	65	63	—
Syria	92	96	—	95	96	—
Turkey	1,003	859	942	980	—	—
Japan	3,553	970	3,873	4,676	5,140	5,340
Pakistan	—	571	—	570	—	—
Philippine Republic	[5]738	567	845	950	1,015	1,050
South America						
Argentina	1,127	—	3,000	3,000	3,150	3,500
Chile	—	430	—	650	650	—
Paraguay	—	[3]113	—	—	185	—
Uruguay	289	323	—	—	330	—
Brazil	—	—	3,330	3,730	3,800	—
Africa						
Egypt	751	[6]694	455	520	525	—
French Morocco	1,000	—	500	—	—	—
Union of S. Africa[7]	—	—	960	955	970	970
Oceania						
Australia[8]	708	1,418	1,288	1,230	1,230	—
New Zealand	430	[9]146	[9]180	[9]185	[9]190	—

[1] Relates to farm production in the United States but many countries not explicit on this point. [2] Three-year average. [3] Four-year average. [4] Years ending May. [5] 1938. [6] For 1947. [7] Years ending June. [8] Commercial production for years ending June 30. [9] Receipts at Marketing Department Stations, year ending March, which account for 30-40% of total production.

POULTRY PRODUCTION IN THAILAND

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Although the principal food of the people of Thailand is rice and fish, a considerable amount of meat is also consumed in the country. Pork is the favorite meat of the people and duck meat comes next.

Chicken production. Although chickens have been raised in Thailand from time immemorial they have not been considered a good source of profit until recently. In many farms the chickens in Thailand live as scavengers. At present, however, the raising of chickens for profit has become so popular in Thailand that this subject is now literally the talk of the people all over the country. Not only the farmers are enthusiastic about poultry raising; even the top officials of the government are keenly interested in it and in its promotion.

The chickens of Thailand are of three distinct types. The so-called Cantonese chickens are popular for the production of both eggs and meat. The Aseel fowls are raised for meat and for fighting purposes. The third type, locally known as "Kai Jay," is common in the farms near the forests. These fowls are not very far removed from the wild Red Jungle fowls and the males are used as decoy to catch the males of the wild fowls. As may be expected, all of the three types are hardy, but they are small, are slow growers, and are poor producers of small eggs. Some Cantonese layers, however, are reputed to lay about 200 eggs each a year. The bulk of the chicken eggs that reach the Bangkok markets from the farms is produced by these fowls.

Of the introduced breeds, S. C. White Leghorns and Rhode Island Reds are the most popular. Australorps are fast increasing in popularity and Barred Plymouth Rocks trail very close behind. These fowls are of good quality; many of those now being raised on the poultry farms in the Bangkok area lay over 200 eggs each a year.

The greater part of the poultry and eggs sold in the markets is produced on general farms where the chickens are allowed to roam around and hunt for their feed. In other words, no special attention is paid to their housing, feeding, and care. It is a common practice among the farmers in the South to take their chickens with them to the farm during the planting and harvesting seasons. On commercial farms, however, the fowls are raised by modern methods of poultry

farming. In the Bangkok area, many of the farmers raise their layers in individual battery laying cages.

The poultry raisers of Thailand will not have to worry about feeds for their poultry for some time to come because the country is self-sufficient in these feeds. Rice, corn, and sorghum are the chief grain feeds. There is an adequate supply of rice bran, and the supply is being conserved by the government by prohibiting its exportation to other countries. The other ingredients of the mash are broken rice (*binlid*), mungo, peanut-oil meal, and soybean-oil meal. Fish meal is locally manufactured. The following laying ration that is being used in the College of Agriculture, Kasetsart University, costs only about fifteen centavos a kilogram:

Ingredients	Amount in Kilograms
Rice bran	60
Broken rice (*binlid*)	8
Ground corn	8
Peanut-oil meal	8
Mungo meal	4
Fish meal	10
Ground oyster shell	2
Common table salt	1
Cod-liver oil	1

The natural method of incubation and brooding is used on the farms in Thailand. Some farmers now use small farm-sized incubators which are either imported from the United States and Australia or are locally made. During the last two years, a number of hatcheries using modern mammoth incubators have been established in the Bangkok area. Although the normal hatching season in Thailand is during December, January, and February, these hatcheries have to function the year round in order to supply the local demand for day-old chicks. In addition to these hatcheries, many duck-egg hatcheries also produce day-old chicks besides ducklings.

The chickens in Thailand are subject to many poultry diseases, the worst of which is the Newcastle disease. Several commercial poultry farmers have suffered serious losses from this disease during the last few years. Roup is particularly bad among the young growing stock. Because of this disease, both brooding and rearing mortalities are high. Fowl cholera, chicken pox, and pullorum are also rampant. The government has started a campaign to eradicate pullorum disease, and if this work is continued with vigor, a time may come when all commercial flocks in Thailand will be free from it. Internal parasites (worms) and external parasites (mites and lice)

also make a heavy drain on the health of the fowls of Thailand, particularly of the imported breeds.

Perhaps about 95 per cent of all chickens and ducks sold in the markets of Bangkok are dressed. For this reason, one of the big markets of Bangkok has a large poultry slaughterhouse where thousands of fowls are killed every day and the dressed poultry distributed to the other markets in the city. The live fowls are shipped to Bangkok from general farms in distant areas by train, by banca, or by freight truck. On the whole, the poultry shipped to Bangkok are healthy and fairly well-fleshed. After being dressed, they are cleverly displayed to make them appear fat and plump. In many cases, the fowls are cut to pieces so that the purchaser may buy only the parts he desires.

Duck production. The duck industry has been a popular and well-established industry in Thailand for a long time. Indeed, the Thais are so fond of duck meat that at present perhaps more ducks than chickens are slaughtered and sold in the markets of Bangkok daily. Some authorities in the Ministry of Agriculture claim that in many places in Thailand more ducks than chickens are raised on the farms. There

Upper left: The live poultry market in Bangkok, Thailand.
Upper right: Bamboo baskets used to hold eggs for sale in Bangkok, Thailand. Each basket contains 25 eggs.
Lower left: Interior view of one of the many duck-egg hatcheries in Bangkok, Thailand. These are the incubators.
Lower right: Sorting the newly-hatched ducklings.

may be some truth to this claim, as may readily be seen when one travels through the various regions of the country.

The duck raisers in Thailand distinguish two distinct types of ducks: one with yellow legs and beak and the other with black legs and beak. Except for these differences, the two types are similar.

The center of the duck industry in Thailand is the region around the city of Bangkok and towards the south along the Gulf of Siam. Here, flocks that number 1000 or more individuals are common. Many thousands of eggs are shipped every day to Bangkok, the center of egg consumption. As a matter of fact, the bulk of the egg supply in this city consists of duck eggs. It has been so for many years now and may be so for many more years to come. To help the consumers, the government lowered the ceiling price of duck eggs to such a level as to be within the easy reach of the great mass of the people. At present the price of duck egg is approximately 50 per cent lower than that of chicken egg. Under this condition, it is difficult to understand how the duck growers make a profit, but they continue raising ducks for egg production just the same.

The duck-egg hatchery business in Thailand is a big business. To supply the needs of the commercial duck raisers and of those who raise small flocks on general farms, there are duck-egg hatcheries in many places in the country. Undoubtedly, the largest number is in Bangkok where there are about twenty, each with a capacity of about 20,000 eggs. These hatcheries are operated by Chinese who also control the marketing of eggs, ducklings, and mature ducks for meat.

The ducks are kept in bamboo houses with nipa roofs. For shade in the yards, sheds made of similar materials are constructed. Once a year the thick layers of duck manure that have accumulated on the floors of the houses are dug and sold at a very good price to commercial vegetable gardens in the Bangkok area, thus providing an excellent source of additional income for the duck raisers. The disposal of the thick accumulation of empty snail shells near the duck houses, however, is a problem to the duck growers.

The feed of the ducks consists mostly of course rice bran, snails, and small fish. Sometimes *binlid* is also given. The mixture of rice bran, *binlid*, and fish is boiled slowly to soften the fish bones. When the ducks are raised inland, they are allowed to forage along the roads and in the rice fields. In this way, the birds can feed on aquatic plants and animals in addition

to rice bran and *binlid*. The ducks are driven to the fields morning and afternoon.

The laying flocks are culled regularly. An "expert culler" goes around the different flocks, handling the birds and removing those that either have ceased to lay or are no longer laying profitably. The operator culls the flock at no cost to the owner provided, however, that all culls are sold to him. He sends these culls to the Bangkok markets which can absorb a considerable number of ducks for butchering. Thus, the old ducks find a ready market in Bangkok. Many of the flocks are culled when the birds are about three years old.

The marketing of duck eggs is under the strict control of the government. The duck raisers are required to sell 80 to 85 per cent of their daily production to the representatives of the Department of Public Welfare. The rest of the produce may be sold in the public market at a price not to exceed the ceiling set by the government. The law also prohibits the movement of duck eggs, that is, nobody is allowed to bring out more than two dozen eggs from the town where these eggs are produced. To get a better price, the duck raisers sometimes smuggle the eggs to other regions and perhaps to neighboring countries as well.

It is surprising that *balut* is not known in Thailand. Thais who have been to the Phillippines and know what *balut* is say that a similar product sells fast in their markets. This so-called *balut*, however, is really an egg the germ of which has died after it has reached the third week of incubation. A duck product that is as popular in Thailand as it is in the Philippines is the salted duck egg. These eggs, however, are not painted red as they are in the Philippines.

In Thailand almost every part of either the chicken or the duck is utilized. In the slaughterhouses, the feathers are saved, dried, and sorted for local use as well as for export. The blood is collected and sold in the form of a cake about two centimeters thick and ten centimeters in diameter. The legs are saved and used in the preparation of soups and other special dishes. The intestines are cleaned and cooked either by boiling or frying. The giblets are sold separately. Roasted and fried ducks are so popular in Thailand that practically no party is without either dish on its menu. For this purpose, the older the ducks are the more they are appreciated. (Thailand: II Animal Industries, The Philippine Agriculturist, Vol. 36: 103-113, 1952)

GROWING BROILERS FOR MAXIMUM RETURNS

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Production of Broilers on a commercial scale is a relatively new industry in this country. Official estimates of commercial broiler production were first made by the United States Department of Agriculture for 1934. In the 18 years from 1934 to 1952 this industry increased its output from 34 million to 886 million broilers—from less than $20 million to nearly $800 million in value. This phenomenal growth was encouraged by favorable economic conditions, especially during postwar years. But the longtime expansion in broiler production as compared with other meats was due mainly to technological improvements that lowered real costs and improved the competitive position of broilers in relation to meats from other sources.

Changes in price relationships provide an approximate measure of the changing position of broilers with respect to costs of production. Average prices received by farmers for commercial broilers in relation to all meat animals were only half as high in 1950-52 as in 1935-39. Rapid adoption of technological improvements resulted in lower costs in terms of feed, labor, and other resources used to produce broilers, and made it profitable for farmers to expand broiler production with relatively lower prices.

The purpose of this paper is to indicate the extent to which these technological advances have improved the efficiency of broiler production and to suggest how broiler producers can take advantage of improvements in technology to maximize economic returns.

The improvement in efficiency that has taken place during the last 25 to 30 years may be measured by comparing the physical efficiency of feed at the beginning of this period with that found today. This can be done by comparing the input-output curves construced from the data on consumption of feed and the corresponding gains in weight.

It is of great importance to producers of broilers to learn what effect the improvements in feed efficiency have had on the economics of broiler production. Is the level of feed efficiency an influential factor in determining the weight to which it pays to feed broilers? How is the most profitable weight affected by different price relationships for broilers and feed.

Finally, we may ask whether these changes and differences have the same effect on the efficiency of producers of commercial broilers who operate on a continuous basis as on that of producers who grow only one or two lots of broilers a year.

FEED-PRODUCTION RELATIONSHIP

In producing meat from broilers, as from other growing animals, the production function follows the principle of diminishing increment. The significance of this relationship is that the relative prices of feed and of broilers determine the point on the diminishing-returns curve to which it pays to feed.[1]

But, as is shown later, the weight to which it pays to feed broilers, is not the same under conditions of continuous production as it is when only an individual lot of broilers is considered.

Data showing input-output relationships for broilers at various weights are seldom available from commercial growers, and, in any case, they are limited to the first 10 to 12 weeks. It is necessary, therefore, to use experimental data although such data may not be identical with those which might be obtained on commercial broiler farms. One of the earliest experiments undertaken for the specific purpose of learning the input-output relationship in growing chickens was carried out by Jull and Titus at Beltsville in 1925.[2] This experiment was set up to test the application of the principle of diminishing increments as applied to growing chickens. A comparision of the results with those from a recent experiment may be used as a rough measure of the improvement in feed efficiency that has taken place in broiler production during the last 25 years.

The Jull-Titus experiment used 170 chicks that were hatched on April 24, 1925. The chicks were from a cross of Rhode Island Reds and Barred Plymouth Rocks. The data include weights of chicks and quantity of feed consumed at the end of each 2-week period up to 24 weeks of age. This information is available for cockerels and pullets separately. Total average consumption of feed was 10.4 pounds to bring the weight of the average broiler to 3.0 pounds. It took about 13½ weeks to reach this weight.

A comparison may be made with a recent experiment conducted by Card and Scott at the University of Illinois.[3] Card and Scott used 50 chicks of each sex from a cross of New

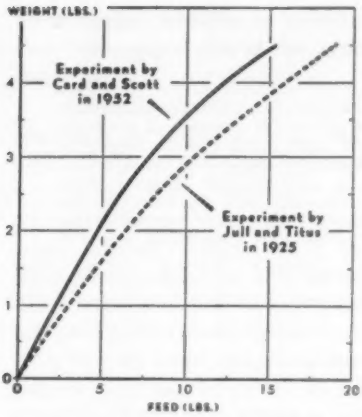


Fig. 1: Input-Output Relationship in Broiler Production — 1952 Compared with 1925.

Hampshire and Barred Plymouth Rocks. The chicks were hatched December 17, 1951. The experiment was set up to obtain data concerning weekly gains and feed consumption beyond the age at which commercial broilers usually are marketed. Data covering weekly gains and feed consumption were kept separately for cockerels and pullets. The records were discontinued at 15 weeks for pullets and 18 weeks for cockerels. The average feed consumption to a weight of 3 pounds was 8 pounds of feed, 23 percent less than was used in 1925. Moreover, this weight was reached more than 3 weeks earlier. The rapid growth obtained in the Illinois experiment is not exceptional. It is about the same as that of broilers entered in the 1951 Chicken-of-Tomorrow Contest.[4] The average feed consumption of some 16,000 broilers in that contest was 8 pounds of feed to a weight of 3 pounds at an age of 10 weeks.

The main reason for increased efficiency of feed apparently lies in the rapid growth of the broilers. The cost of body maintenance of chickens is relatively high. Large savings in the quantity of feed used for maintenance are made possible by reducing the length of time a chick needs to reach a weight of 3 pounds.

A comparison of the input-output relationship in 1925 with that found in 1952 is shown in figure 1. The 1952 curve is steeper than the 1925 curve as a result of the reduction in the quantity of feed needed for each unit of gain. The curves for both 1952 and 1925 represent an efficiency of feed above the level reached by the average grower of broilers during the respective years. The difference between the two curves may be taken as a conservative measure of the improvement in the efficiency of feed that has taken place during this period as a result of improved breeding and advances in poultry nutrition. Commercial production of broilers was only the beginning in 1925. Probably more growers of broilers lagged behind the experimental results in 1925 than in 1952. The

effect of improved breeding on flocks in 1950 is indicated by H. L. Shrader in a recent article, from which we quote:

> "There has been widespread use of the improved Chicken-of-Tomorrow breeding stock. A survey of the Chicken-of-Tomorrow contestants brought out that at least 67 percent of the commercial broiler chickens grown in 1950 carried these improved blood lines. This means that at least 400 million of the 616 million commercial broilers raised in 1950 carried some of these improved qualities. The average broiler will continue to improve as fast as the breeders can establish more multiplication flocks and complete further refinements in their blood lines."[5]

If the actual conditions that existed in 1925 and in 1952 with respect to use of feed by growers of broilers were fully known they might well show a greater improvement in the efficiency of feed for the average producer than the 23 percent shown for a 3-pound broiler in the expirments. A recent report from Virginia shows, for example, that during 1947-52 the quantity of feed used declined 23 percent and the time needed to produce broilers decreased 20 percent.[6]

EFFECT OF TECHNOLOGICAL IMPROVEMENTS ON PRODUCTION COSTS

Cost of feed represents the largest single expense in the production of broilers. Feed accounts for half to two-thirds of total costs, depending upon the level of feed efficiency and other factors. A reduction of 23 percent or more in the average quantity of feed needed to produce a 3-pound broiler is therefore of great importance so far as the competitive position of the broiler industry is concerned.

To examine what effect this improvement has had on the economics of broiler production, data from the experiments in 1925 and 1952 may be used to represent the range between an inefficient producer and a very efficient producer. The two curves in figure 1 represent the two extreme possibilities. Most producers lie somewhere between these two extremes. The average feed used for a 3-pound broiler in well-managed flocks was reported by McAllister and Bausman to be down to 9.3 pounds in 1948-49.[7] Since then the efficiency of such flocks has undoubtedly improved.

In addition to the cost of feed a producer of broilers has certain other cash expenses that must be covered before he obtains any return for his labor and fixed investment. These include the outlays for chicks, fuel, and medicine. Such costs as those of buildings, equipment, interest, and taxes must be covered over a longer period. Many costs are fixed—they go on even if no broilers are produced, once the investment has

been made. Moreover, costs vary greatly among producers depending upon the type and quality of buildings and equipment used.

If broilers are produced with the use of family labor, that too takes on the nature of a fixed cost. In the Delaware study cited above, family labor accounted for 63 percent of all labor used in producing broilers.[8] Even in the case of big producers who hire labor, this cost may be considered as fixed, as such labor is usually hired on a continuing or annual basis. Big producers look to the total returns for the year, for it is from these that they must pay the cost of labor before they are able to ascertain the returns of their investments.

To avoid becoming involved in the many variations in expenses incurred for labor and fixed costs among producers of broilers, the data in table 1 are set up to show returns to the operator after out-of-pocket or direct expenses such as feed, chicks, fuel, and medicine are deducted. For the purpose of presenting comparable estimates at different weights, a mortality rate of one-half of 1 percent a week was used in estimating the cost of mortality. The mortality cost represents each surviving bird's share of all the direct costs incurred by dead birds up to the time of their death.

MAXIMIZING RETURNS PER BROILER

The returns per broiler at different weights are shown in table 1 for the two types of broilers considered here. The greatest return per broiler among efficient feed users is at a weight considerably above 3 pounds, both when the price is 25 cents and when it is 30 cents a pound, with feed at $5 per 100 pounds. The higher the price for broilers compared with feed, the higher the weight at which maximum returns is obtained. This holds true for broilers that convert feed into meat less efficiently. But for the less efficient users of feed it would not pay to continue to produce broilers with a broiler-feed ratio of 5:1 because 0.2 cents per broiler would not be a large enough return even if family labor were used. At a price ratio of 6:1 the returns above direct costs would amount to 15.2 cents per broiler at a weight of 3 pounds, and the largest return of 17 cents per broiler would be obtained at a weight of 3.75 pounds.

The assumed price relationships of 5:1 and 6:1 were chosen for this illustration because the annual broiler-feed ratio has been within this range for the last 4 years in the Delmarva area. The weekly ratio has varied erratically during each year, but it has fallen within these limits 56 percent of

TABLE I

Weight Cost and Return per Broiler, with High and Low Feed Efficiency, at Specified Ages.

Estimated age	Weight	Feed used		Cost of chicks, fuel, mortality, and medicine[2]	Return per broiler, above direct cost,[3] when price per pound is—	
		Quantity	Cost[1]		25 cents	30 cents
Days	Pounds	Pounds	Cents	Cents	Cents	Cents
High feed efficiency						
58	2.25	5.3	26.5	21.3	8.4	19.7
62	2.50	6.2	31.0	21.6	9.9	22.4
66	2.75	7.1	35.5	21.7	11.6	25.3
71	3.00	8.0	40.0	21.9	13.1	28.1
75	3.25	8.8	44.0	22.0	15.3	31.5
80	3.50	9.8	49.0	22.3	*16.2*	33.7
85	3.75	11.0	55.0	22.7	16.1	34.8
90	4.00	12.3	61.5	22.9	15.6	35.6
96	4.25	13.7	68.5	23.3	14.5	*35.7*
101	4.50	15.4	77.0	23.8	11.7	34.2
Low feed efficiency						
80	2.25	7.2	36.0	21.9	—1.7	9.6
87	2.50	8.2	41.0	22.2	— .7	11.8
93	2.75	9.3	46.5	22.5	— .3	13.5
97	3.00	10.4	52.0	22.8	+ .2	15.2
101	3.25	11.8	59.0	23.1	— .8	15.4
108	3.50	13.0	65.0	23.5	—1.0	16.5
115	3.75	14.3	71.5	24.0	—1.8	*17.0*
122	4.00	15.8	79.0	24.4	—3.4	16.6
127	4.25	17.3	86.5	24.8	—5.1	16.2
132	4.50	19.0	95.0	25.3	—7.8	14.7

[1] Cost of feed $5.00 per 100 pounds.

[2] Mortality estimated at one-half of 1 percent a week with cost of fuel, medicine, and chicks estimated at 20 cents per chick.

[3] Direct costs include feed, chicks, mortality, fuel, and medicine but not labor and fixed costs such as buildings, equipment, interest, taxes, and insurance. Cost of litter is estimated to offset value of manure.

the weeks during these 4 years, with about as many weeks above as below.

If the broilers belong to a good meat-producing strain with high feed efficiency, the table shows that it would pay a grower of broilers using $5 feed to feed them to 3.5 pounds when the price of chickens was 25 cents a pound. It would pay to feed them to 4 or 4.25 pounds if the price was 30 cents a pound. After a weight of 3.25 pounds is reached the rate of increase in returns decreases with each additional quarter pound gain in weight. The increase per broiler is greater from 3.25 to 3.5 pounds than from 3.5 to 4.25 pounds. But in general, the higher the price of broilers compared with feed, the higher the weight of the broiler before the cost per unit of

gain equals the value of the gain. This is illustrated in figure 2. Although most producers of broilers are probably not quite so efficient as the more efficient producer in this example, it seems clear from these data that it would pay them to feed broilers to more than 3 pounds under the assumed prices.

Among the inefficient broilers shown in the table the highest return with a broiler-feed price ratio of 6:1 was at a weight of 3.75 pounds. It would almost certainly pay producers whose flocks have a higher feed efficiency to feed broilers to a weight considerably above 3 pounds, that is, if they are concerned only with maximizing returns from individual lots. But this is not the case for commercial producers who operate on a continuous basis.

MAXIMIZING ANNUAL RETURNS

Producers of commercial broilers with continuous production must consider another factor. If a continuous producer of broilers should keep his birds to a weight of more than 3 to 3.5 pounds (depending on efficiency), he would be likely to lose more in annual returns because of a reduction in the number of lots he could produce during a year, than he would gain by keeping the broilers to a higher weight. Highest net returns for the whole year is the goal for any producer. This goal is attainable when broilers are kept to higher weights in the case of producers who limit themselves to 2 or 3 lots a year.

Continuous producers, who allow only about 2 weeks between lots to get broiler houses cleaned and ready for the next lots, must, however, consider the possible reduction in annual returns they will incur by reducing the number of lots when they feed the broilers to higher weights. By adapting the data in table 1 to continuous production we may ascertain the age and weight at which returns are likely to be greatest for the year. This is done by adding 2 weeks to the age of broilers at each given weight, determining from this how many lots it is possible to produce a year, and computing the returns above out-of-pocket or direct cost on an annual basis.

The estimates that are shown in table 2 are based on an operating unit producing 12,000 broilers a lot. Annual returns above direct cash expenses were computed for the number of broilers that could be produced at each weight.

Estimates were made on the basis of broiler prices of 25 and 30 cents a pound. In both, feed was assumed to cost $5 per 100 pounds. This corresponds to a broiler-feed price ratio of

TABLE II

Weight, Production, and Total Return Above Direct Cost of Broilers, with High and Low Feed Efficiency, at Specified Ages.

Estimated age plus 2 weeks	Weight	Lots per year[1]	Broilers produced annually[2]	Annual return, above direct cost, when price per pound of broilers is [3]	
				25 cents	30 cents
Days	Pounds	Number	Number	Dollars	Dollars
	High feed efficiency				
72	2.25	5.1	61,200	5,141	12,056
76	2.50	4.8	57,600	5,702	12,902
80	2.75	4.6	55,200	6,403	13,966
85	3.00	4.3	51,600	6,760	14,500
89	3.25	4.1	49,200	7,528	15,498
94	3.50	3.9	46,800	*7,582*	*15,772*
99	3.75	3.7	44,400	7,148	15,451
104	4.00	3.5	42,000	6,552	14,952
110	4.25	3.3	39,600	5,742	14,137
	Low feed efficiency				
94	2.25	3.9	46,800	— 796	4,493
101	2.50	3.6	43,200	— 302	5,098
107	2.75	3.4	40,800	— 122	5,508
111	3.00	3.3	39,600	+ *79*	*6,019*
115	3.25	3.2	38,400	— 307	5,914
122	3.50	3.0	36,000	— 360	5,940
129	3.75	2.8	33,600	— 605	5,712
136	4.00	2.7	32,400	—1,102	5,378
141	4.25	2.6	31,200	—1.591	5,054

[1] Estimated number of lots of 12,000 broilers each that could be produced per year allowing 2 weeks between lots for cleaning and disinfecting broiler house and equipment.

[2] The number of broilers started for each weight would be as much higher as the mortality at that particular age required. For example, in the high feed efficiency group at a weight of 3.0 pounds it would be necessary to start (51,600 x 105) 54,180 in order to sell 51,600 broilers.

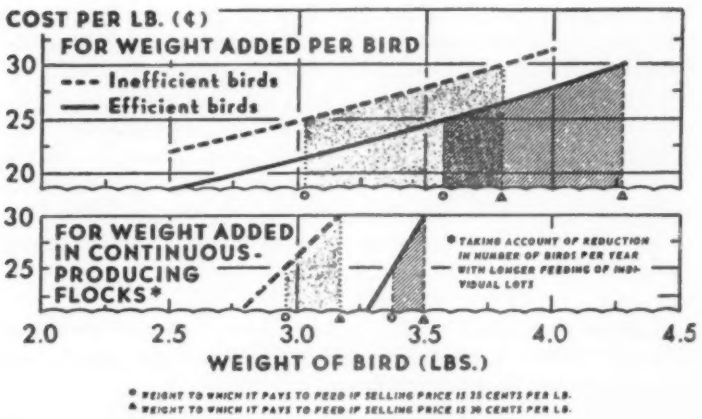
[3] Direct costs include feed, chicks, mortality, fuel, and medicine but not labor and fixed costs such as buildings, equipment, interest, taxes, and insurance. Cost of litter is estimated to offset value of manure.

5:1 and 6:1, which may be accepted to represent reasonably well the range in the current normal annual relationship between broiler and feed prices.

The table shows that, within the price assumptions used, broiler producers who operate continuously by starting a new lot of broilers within 2 weeks after the sale of the preceding lot obtain their largest annual return by selling the broilers at a weight somewhere between 3.0 and 3.5 pounds, depending upon feed efficiency. This result helps to explain why, in areas in which producers operate continuously, most broilers are sold at an average weight slightly above 3 pounds.

Producers who are interested in maximizing annual net returns to management and fixed resources must pay attention to the number of broilers produced as well as to returns per bird. Total net returns, of course, are determined by number of birds and net return per bird. In table 2 net returns obtained per bird produced are not maximized at weights between 3.0 and 3.5 pounds. But by selling broilers at these weights it is possible to produce more in a year and thereby to realize larger annual net returns. It should be evident, therefore, that the weight to which it is most profitable for producers to grow broilers does not depend solely upon the broiler-feed price ratio.

The marginal cost analysis, shown in the upper part of figure 2, indicates the weight to which it pays to feed broilers if maximum returns per bird is the objective. Broilers that are efficient feed converters reach a considerable higher weight than those that are inefficient, before the cost of the last pound of gain equals the price received. In the lower part of the chart (fig. 2) the marginal cost analysis is applied to continuous production of broilers. This lower segment brings out two important considerations: (1) The weight at which the average marginal cost equals the price received is lower for both types of broilers than in the segment above; (2) the marginal cost increases so sharply that the most profitable selling weight of the broilers would be increased so slightly by an increase in the price of broilers that a producer in practice could not take advantage of the change.



* WEIGHT TO WHICH IT PAYS TO FEED IF SELLING PRICE IS 25 CENTS PER LB.
▲ WEIGHT TO WHICH IT PAYS TO FEED IF SELLING PRICE IS 30 CENTS PER LB.

Fig. 2: Marginal Costs in Broiler Production.

Many producers who grow from 1 to 3 lots a year sell their broilers at a weight of about 3 pounds, although the data presented in table 1 show that a higher return per broiler could be obtained by keeping them to a higher weight. For producers who grow only a few lots a year the length of time in itself is less significant as the broilerhouse stands empty part of the year anyway. However, with many of these farmers broiler production is a supplementary enterprise fitted into their regular farm operation and available labor supply. It may be that selling the broilers at about 3 pounds brings these farmers their largest annual returns because this is the highest profit combination for their farms.

To explain why farmers who produce less than 3 lots of broilers a year do not feed them to heavier weights, more information is needed. The supplementary nature of the broiler enterprise partly explains it, but more needs to be known about how broiler growing fits into the whole farm organization. For example, we need to know whether farmers who produce 1 to 3 lots of broilers a year follow a definite pattern each year in order to utilize available labor. It would also be useful to know whether the quantity of home-produced grain in the broiler ration used by these growers is greater than that in the ration used by other producers.

Variation in the weights at which broilers are sold in different parts of the country is apparently caused by local preferences. In New England a premium is paid for heavy broilers, which accounts for the high average weight of broilers marketed in this region, as compared with the much lower average weight of broilers in such States as Texas and Georgia. These differences in the market must be taken into consideration by producers when planning their production of broilers and deciding when to sell. An important factor in carrying broilers to higher weights is the risk resulting from a greater than average increase in cost of mortality as the broilers become larger and more valuable. Many producers may prefer to sell as soon as a market is available rather than incur additional risk that would reduce or might even wipe out their profits.

CONCLUSIONS

Data presented in this paper show that two different types of broiler producers may maximize returns above out-of-pocket costs in different ways.

A broiler producer who each year grows fewer lots than he can handle on a continuous basis would probably maximize

his returns if he fed his broilers to a higher weight than the 3 pounds, which now is the national average. Efficient feed converters can be economically fed to higher weights than inefficient ones. From an economic standpoint, the weight to which both efficient and inefficient broilers can be fed varies directly with the relatively favorable or unfavorable character of the broiler-feed price ratio.

Broiler producers who operate continuously obtain their greatest annual return by producing somewhere between 3.3 and 4.1 lots a year, depending upon the feed efficiency of the birds. These producers sell broilers at an average weight of 3.0 to 3.5 pounds, most of them probably at an average close to 3.25 pounds, slightly higher than the average weight at which broilers usually are sold. It suggests that most commercial producers are feeding to a weight which gives them the greatest annual returns. The marginal cost analysis in figure 2 shows that continuous producers cannot significantly increase their annual returns by changing the average selling weight of the broilers.

Producers of broilers may take advantage of increasing prices to obtain a larger return on an individual lot, but a continuous producer who varies his pattern of production for this purpose could easily lose as much on succeeding lots during the year as he gains on an individual lot held to higher weights. With any change in original plans, both types of producers run into practical difficulties connected with the greatest space needed for larger broilers.—(Agricultural Economics Research, Volume V, No. 4, October, 1953.)

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FEED REQUIREMENTS OF TURKEYS AS RELATED TO TIME OF YEAR

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In order to facilitate advance estimations of feed ingredient requirements, based upon poults brooded, a survey was made of four years' collection of data obtained on the Turkey Experimental Farm of the Grange Company. During this period, 1949-1952, a number of flocks of Beltsville Small White (BSW) and of Broad Breasted Bronze (BBB) turkeys had been reared under practical conditions and management at different times of the years.

It has been assumed for the present purposes that the different lots of the same variety that were raised, through the same age periods, were similar turkeys. The climate from year to year cannot be controlled under field rearing conditions and it has been assumed that the climate was similar for the 4 years of observations. This, in general, is correct. The climate in the area of Modesto can be classified as moderate, rarely reaching a temperature of freezing during the winter months, but frequently attaining temperatures over 100°F. during the summer months.

The data selected for analysis were those from birds on standard starting and growing mashes, and grain, fed free choice, or essentially similar diets. All groups on any given diet contained 300 or more birds. None of the groups encountered serious disease. All birds were representative of good commercial breeds available in the area.

The period in which the birds were grown in field pens is the one of most interest for the present discussion. During this period the turkeys were provided with shades overhead, but no windbreaks. They were almost fully exposed to changes in climate.

The data for the BSW turkeys were analyzed for the age period 12 to 18 weeks age, approximately. The average feed requirements, etc., were obtained at a number of midpoints of the growing period, for comparable lots of turkeys which were grown at different seasons. These results were plotted against time of the year expressed in months, as shown in Figs. I and II.

Information obtained with BBB turkeys was divided into two field growing periods of 14 to 20 weeks and of 20 to 24 weeks. Insufficient data were available beyond 24 weeks age.

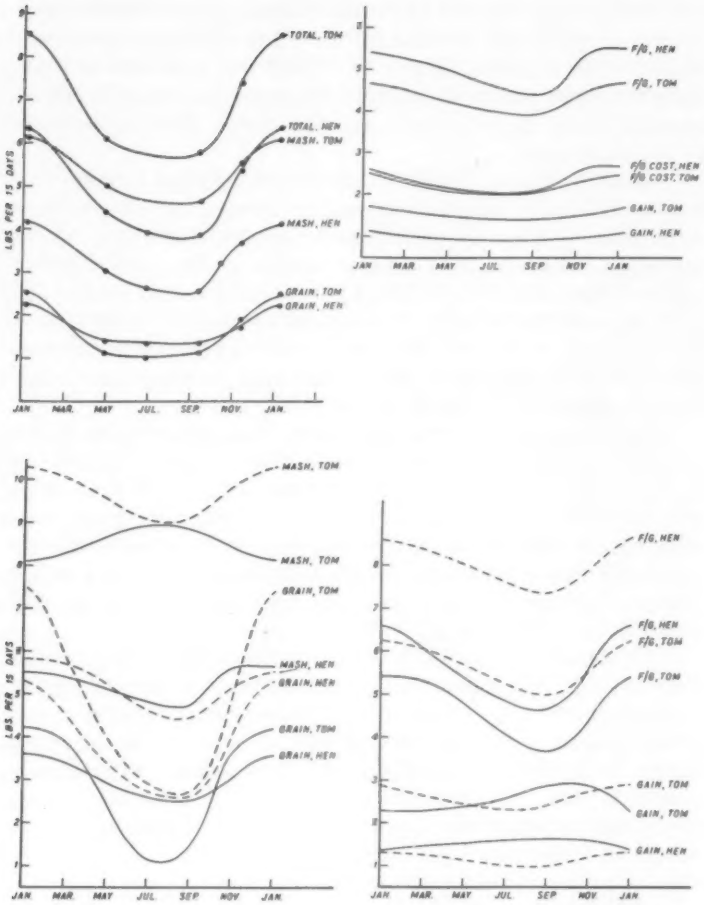

Fig. I. Relation of time of year to mash, grain and total feed intake of Beltsville Small White Turkeys during the range rearing period of 12 to 18 weeks age.

Fig. II. Relation of time of year to weight gains in lbs. per 15 days, feed/gain ratio, and relative feed costs per lb. gain of Beltsville Small White Turkeys during the range rearing period of 12 to 18 weeks age.

Fig. III. Relation of time of year to mash, grain and total feed intake of Broad Breasted Bronze Turkeys during the range rearing periods of 14 to 20 weeks age (solid lines), and 20 to 24 weeks age (broken lines).

Fig. IV. Relation of time of year to weight gains in lbs. per 15 days, and feed/gain ratio of Broad Breasted Bronze Turkeys during the range rearing periods of 14 to 20 weeks age (solid lines), and 20 to 24 weeks age (broken lines).

Results were plotted and again the various points fell into very consistent patterns. In case of the BBB the data have been presented in Figures III and IV. These are sufficient to illustrate the main points of interest. It should be remembered in viewing these figures that any one curve represents birds of the same age.

Mash intake by the BSW and the older BBB turkeys followed strikingly parallel courses, in comparing either toms with hens, or the two varieties of turkeys. The mash intake increased notably as the climate became cooler, probably because of the tendency of these birds to eat more of every type of food available in order to maintain the necessary heat production. It is of interest that the specific types mentioned also gained weight somewhat more rapidly in cooler weather, under the stimulus of the increased mash intake.

In contrast, the younger BBB toms showed in cooler weather a reduction in rate of gain. This, possibly, is related to the cold weather stimulus to consume grain, if the result as indicated in this case was to cause an excessive grain consumption in relation to the proper amount of mash for these relatively young birds. It may have been advisable to restrict the grain intake of these younger BBB turkeys during cold weather in order to promote higher mash intake.

Grain intake showed large variations (up to 300%) with time of year, passing through a marked minimum during the hot months of July, August, and September and then rising abruptly during the cool to cold months. The decline of grain intake from the January-February high point was relatively slower toward July, as is the elevation of the prevailing average temperature. After September, the climate changes rather quickly toward one of cool mornings and cool to cold nights. At this time the grain intake began to increase rapidly.

Total feed required per lb. of weight gain was less for toms as compared to hens at any time of the year. In the case of the younger birds the spread in feed/gain ratio between the sexes increased in cooler weather. This observation may be a result of the earlier tendency of the hen to convert more feed to fat, especially in cooler weather. It may be estimated that this conversion requires approximately 4 lbs. of feed to every lb. of body fat formed. Fat replaces an equal volume of water in tissues, and since fat is lighter than water, this fact is a further unfavorable factor in reference to feed/gain ratio. The large effect of season, as well as age, sex and diet, on feed/gain ratios makes it evident that comparison of feed

TABLE I

Relative Feed Effciencies of Hens as Compared to Toms, %

Midpoint of Period	1-Jan.	1-March	1-May	1-July	1-Sept.	1-Nov.
Kind of Turkey						
Beltsville Small White	85	85	86	92	91	86
B.B. Bronze 14-20 Weeks Age	82	88	89	85	80	79
B.B. Bronze 20-24 Weeks Age	72	72	71	69	68	69

* Toms rated as 100 in each case.

efficiencies cannot be made except under identical conditions.

Table I shows a tendency for the BSW hens and younger BBB hens, as compared to toms, to increase in *relative* efficiency of conversion of feed during the warm months. In the case of the older BB Bronze, there was very little change in relative feed efficiency of the sexes with time of year.

While the above facts regarding feed selection and gains are enlightening, a more ultimate concern of the turkey producer is feed costs of gain. Although change of climate had, in some cases, caused marked changes in proportion of grain to mash consumed, minimum feed cost per lb. of gain was in every case attained during the warm to hot months.

The differences in feed cost per lb. gain between toms and hens of the BSW or younger BBB became less or even vanished during the hottest periods. Feed cost per lb. of gain of hens, less that of toms, changed from 2.0¢ to almost nothing in the case of the BSW. Similarly, the change in younger BBB was from 5.2¢ in cold weather to 1.4¢ in warm weather. This observation may be related to the fact that hens consistently consumed a higher proportion of grain to mash, during the hot weather, hence selected a cheaper diet than was the case with toms. As previously mentioned, the spread in feed/gain ratio also decreased during this time. These two trends were sufficient to bring feed costs per lb. gain closer together. This tendency was reversed in colder weather, especially when the toms began to eat more grain than did the hens. On the other hand, the older BBB showed no appreciable change in the spread between feed costs, the hens being uniformly about 10¢ more expensive than toms per lb. gain.

As another means of expressing some of these comparisons relative data for hens and toms are given in Tables II and III.

TABLE II

Effect of Time of Year on Relative Gains, Feed/Gain Ratios and Feed Costs per Lb. of Gain

Beltsville Small White Turkey on Range, 12 to 18 weeks age

Midpoint of Period		1-Jan.	1-March	1-May	1-July	1-Sept.	1-Nov.
Relative Gain	Tom	195	178	167	156	161	172
	Hen	122	111	103	100	100	105
Relative Feed/Gain ratio	Tom	127	116	105	103	100	115
	Hen	148	137	122	112	109	133
Relative Feed Cost Per Lb. Gain	Tom	132	113	106	101	105	118
	Hen	142	118	108	100	106	129

TABLE III

Effect of Time of Year on Relative Gains ,Feed/Gain Ratios and Feed Costs per Lb. of Gain

Broad Breasted Bronze Turkey on Range

Midpoint of Period		1-Jan.	1-March	1-May	1-July	1-Sept.	1-Nov.
14 to 20 Weeks Age							
Relative Gain	Tom	168	168	174	186	208	203
	Hen	100	107	111	113	117	116
Relative Feed/Gain Ratio	Tom	150	147	131	111	100	119
	Hen	184	167	147	133	125	151
Relative Feed Cost Per Lb. Gain	Tom	140	138	128	112	100	112
	Hen	168	153	136	123	116	140
20 to 24 Weeks Age							
Relative Gain	Tom	299	274	249	237	247	282
	Hen	135	127	114	101	100	122
Relative Feed/Gain Ratio	Tom	125	122	114	105	100	109
	Hen	174	168	162	153	148	158
Relative Feed Cost Per Lb. Gain	Tom	116	115	112	105	100	105
	Hen	159	156	153	145	140	146

USE AND ABUSE OF MEDICANTS IN THE FEED

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Chemotherapy for poultry disease control has brought along with its gain a number of disadvantages and additional responsibilities. Since the only practicable way of medicating large numbers of chickens economically is in the ration, the feed industry is forced to act as a despensing pharmacist. The industry, therefore, must assume the same obligations that the ethical pharmacist has to the public, that is purity and potency of drugs used, proper compounding of prescriptions, careful review of dosage to prevent poisoning. Sometimes the trend toward pharmaco-nutrition has been so strong that it often appears as if the function of the feed in the sack is not to provide an adequate ration but to serve as a vehicle for the drug mix. Furthermore, whether by design or accident, the feed distributors often act as physicians and make the diagnoses as well as the pharmacists who compound the prescriptions.

Specific medication will be effective only when the diagnosis is accurate. The symptoms in chickens produced by the acute type of intestinal coccidiosis caused by *E. brunetti* are practically the same as those caused by so-called "blue comb" disease. To treat the coccidiosis infection with muriate of potash (the treatment for "blue comb") will obviously be useless.

The nature of the medication and its innate toxity particularly its safety factor must be kept in mind.[2,3,8] Where the factor of safety is narrow, the uniform distribution of the medicant in the feed is of critical importance. This involves problems not only of proper mechanical mixing but also the physical properties of the medicant. Acute deaths of fowls from ready mixed medication are extremely rare. It does occur in cases of premeditated criminal acts or by accident. Undoubtedly, subacute intoxication occurs more commonly and often these are not recognized. The recent demonstration of the unfavorable effect of 2-amino-5-nitrothiazole on the reproductive tracts of chickens medicated over a period of time is a case in point.[6,9] The possible injury to birds by individual bird treatment or medication of water with drugs already in the feed is not far-fetched and actually has occurred.

It has been shown that some medications mixed in poultry feeds are incompatible with certain nutritional elements in the ration or with other medications placed in the feed. Para-amino-benzoic acid which is advocated in some quarters for handling chronic respiratory diseases is directly antagonistic to the action of sulfonamides commonly used for coccidiosis control. Flowers of sulfur, a coccidiostatic agent widely used in some sections of the United States, interferes with normal bone formation in chickens receiving adequate rations. In such instances significant increases in Vitamin D must be provided to overcome "sulfur rickets."[5] Some of the sulfonamides have a definite effect on the calcium deposition for shell formation in laying fowls.[1]

An important factor in medicating through the feed is the palatability of the resultant mixture. One of the limiting factors in the use of tobacco dust as a vermicide in the early days was reluctance of the birds to consume the medicated feed. Similar difficulties have been encountered in the field with 2-amino-5-nitrothiazole in medication of chickens.

The palatability and healthfulness of poultry meat and eggs originated from medicated poultry for humans cannot be overlooked. Fishy flavor of meat due to cod liver oil feeding of turkeys is well known. The awareness by federal agencies of undesirable physiological and toxic effects on humans resulting from ingestion of harmful substances is well known. Antibiotic medications sold to dairy farmers and used promiscuously has been sharply criticized when detectable amounts were found in the milk. Were it not for the fact that high concentrations of antibiotics are so costly, even more generous use of these substances would be made by poultrymen. As matters stand, enough antibiotics are sold without justification anyway.

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(Proceedings of the 1953 Cornell Nutrition Conference for Feed Manufacturers, Nov. 1953.)

REVIEW OF POULTRY PUBLICATIONS

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GENETICS

BLOW, W. L., and E. W. GLAZENER. (North Carolina Agric. Expt. Sta., Raleigh.)

THE EFFECT OF INBREEDING ON SOME PRODUCTION CHARACTERS IN POULTRY. *Poultry Sci. 32(4):* 696-701. 1953.—Estimates of the regression of performance of various characters in poultry on the degree of inbreeding were derived from data on 3538 pullets from 482 dams and 64 sires. These estimates were based on the average performance of groups of full sisters, and variances and covariances were calculated from an intra-sire and intra-year analysis. These regressions for different aspects of performance were as follows. Body wt. (g.) –1.044 ± .851; Egg wt. (g.) –.018 ± .021; Sexual maturity (days) .315 ± .013; Egg production (6 mos.) –.302 ± .112; Hatchability (% of fertile eggs) –.371 ± .111. These estimates were in reasonably close agreement with previously reported regressions for these characters.—*Authors.* (Biological Abstracts)

GODFREY, EDWARD F. (U. Tennessee, Knoxville), **B. B. BOHREN.** (Purdue U., Lafayette) **and R. GEORGE JAAP.** (Ohio State U., Columbus.)

JITTERY, A SEX-LINKED NERVOUS DISORDER IN THE CHICK. *Jour. Heredity 44:* 108-112. Illus. 1953.—A condition in day-old chicks referred to as "jittery," in which the head is retracted over the back, accompanied by a rapid shaking of the head was studied. The condition is highly lethal in post natal stages, with 1 or 2% of affected chicks reaching maturity. Expression in surviving adults is similar to that in the chick. Breeding tests show the gene for "jittery" to be a sex-linked recessive. Linkage data from 805 gametes produced little or no evidence of linkage with the sex-linked genes which produce barring, silver, and slow feathering. These data indicate that the gene for "jittery" is located distally on the sex chromosome from the other genes involved; this suggests that the sex chromosome linkage map of the fowl may be much longer than presently descr. Histological examination of affected chicks revealed marked degeneration of the Purkinjie cells of the cerebellar region.—*Auth. abst.* (Biological Abstracts)

KIMBALL, ELLIOT. (Clinton Exptl. Farm., Clinton, Conn.)

GENETICS OF BUTTERCUP PLUMAGE PATTERN IN THE FOWL. *Poultry Sci. 32:* 683-692. Illus. 1953.—The Buttercup breed of domestic fowl carries wild type primary plumage pattern *(e⁺e⁺)*, and is a double homozygote for the secondary patterns stippling and barring *(Sg Sg Bg Bg)*. Dominant alleles of secondary pattern genes at different loci are additive in general melanin-restricting effect, but specific pattern-effect within the feather germ is subject to epistasis relations. The significance of wild type as standard of reference, and the importance of differentiating between primary and secondary pattern genes in plumage pattern analysis is emphasized. Exptl. rationale for detn. of primary pattern genotype in members of the genus *Gallus* is outlined.—*Elliot Kimball.* (Biological Abstracts)

LANDAUER, WALTER. (U. Connecticut, Storrs.)
GENETIC AND ENVIRONMENTAL FACTORS IN THE TERATOGENIC EFFECTS OF BORIC ACID ON CHICKEN EMBRYOS. *Genetics 38:* 216-228. 1953.—Experiments relative to the teratogenic effects of boric acid on embryos of Silver Gray Dorking, White Leghorn, Black and White Minorca fowl and of reciprocal crosses between the 2 Minorca breeds and White Leghorn x White Minorca gave the following results: Seasonal trends (decline in incidence of induced defects during spring) exist in some breeds, especially in Black Minorcas. Within breeds significant heterogeneity in response was found between mothers. The embryos of the 2 colored breeds (Dorking and Black Minorca) gave a higher incidence of malformations than those of the white breeds. Plumage color of the mother had a definite effect on response of her progeny to boric acid. In segregating progenies white (and also black) embryos from black mothers showed more malformations than those from white mothers. The phenotypical down color of the embryos had a similar, but lesser, influence on response.—*Walter Landauer.* (Biological Abstracts)

PHYSIOLOGY

ANDERSON, C. L. (Oregon Agric. Expt. Sta., Corvallis.)
EFFECT OF TESTOSTERONE ON PULLETS. *Poultry Sci. 32:* 883-884. 1953.—New Hampshire and Delaware x New Hampshire pullet chicks fed rations containing 5, 15 and 45 mg. of methyl testosterone per pound of feed weighed no more than control pullets at 4, 6, 8 and 10 weeks of age. Pullets fed the control ration to 6 weeks and a ration with 5 mg. testosterone from 6 to 10 weeks also were no heavier than the controls. The feeding of methyl testosterone had no influence on the efficiency of feed use.—*Auth. abst.* (Biological Abstracts)

ANDREWS, F. N., S. R. MILES, and O. S. DAVIS. (Purdue U., Lafayette, Ind.)
RESPONSE OF INBRED LINES OF CHICKENS TO THIOURACIL. *Endocrinology 52:* 712-718. 1953.—Five lines of chickens, varying in inbreeding coefficients from 0 to 78%, were fed thiouracil at a level of 0.2% of the diet from the 2d to the 14th day of post-hatching. There were considerable differences between lines in gross and relative thyroid wt. Growth rate, expressed as 13-day gain, varied highly significantly between lines. Thiouracil had a highly significant depressing effect on rate of gain. Thiouracil depressed the growth rate about 30%. Thus the rate was depressed more in grams in a fast-growing line than in one which grew slowly. Using inbred line averages, the correlation coefficient of 0.92 was obtained when 1 variable was the avg. gain in grams on both diets and the other variable was the avg. thyroid wt. in milligrams on the thiouracil diet. Thyroid wt. and 13-day gain of chicks with the same sire and dam varied more in line 1 (37.5% inbred) than in line 2 (78% inbred). Lines 1 and 2 and their reciprocal crosses were compared. The gains of the reciprocal crosses were between the gains of the 2 parental lines but closer to the gains of the faster-gaining line, 1. Gross thyroid wts. of the crosses were nearly midway between the gland wts. of the parents. Relative thyroid wts. of the crosses were similar to those of the parent with the lower relative thyroid wt.—*Auth. summ.* (Biological Abstracts)

BENNETT, H. STANLEY. (U. Washington, Seattle.), **KEITH R. PORTER.** (Rockefeller Inst. Med. Res., N. Y. C.)
AN ELECTRON MICROSCOPE STUDY OF SECTIONED BREAST MUSCLE OF THE DOMESTIC FOWL. *Amer. Jour. Anat. 93:* 61-106. Illus. 1953.—Thin sections of relaxed and contracted chicken breast muscle fixed in buffered osmic acid have been studied with the electron microscope. The sarcolemma is seen as a membrane 150-250 Å thick, with collagenous fibers on the outside. Muscle columns, myofibrils, and myofilaments are recognized. The myofilaments display a 225 Å longitudinal periodicity, and in cross section are arranged in hexagonal

close packing within the myofibril, the filaments being spaced 350-380 Å apart in each row. In the sarcoplasm one can identify the sarcosomes, or mitochondria, the sarcoplamsic reticulum which corresponds to the cross fiber reticulum of Retzius, and the sarcoplasmic matrix. The sarcoplasmic reticulum displays a continuity with the Z band in relaxed muscle, connecting the telophragma with sarcosomes and with the sarcolemma. The cross-bands of the sarcomere are maxima or minima in density as one scans the fiber longitudinally. Transitions between bands are gradual rather than sharp. On contraction, all sarcomere bands increase in density and osmium-binding capacity, the J and Z gaining more density than the Q. A movement of sarcoplasmic reticulum into the myofibril during contraction is postulated.—*Auth.* (courtesy Wistar Bibl. Serv.).

BRANT, JOHN W. A. (U. Illinois, Urbana.)
MORPHOLOGY AND ALBUMEN SECRETION OF THE AVIAN OVIDUCT AS CONTROLLED BY SEX HORMONES. *91p. Dissertation (Publ. 5221):* Univ. of Illinois, 1953. Microfilm available from Univ. Microfilms, Ann Arbor, Mich., Pr. $1.14; enlargements, 10c per page.—The undeveloped oviducts of pullets 60-70 days old, which were presumed to be free of effective levels of endogenous sex hormones, were primed with estrogen, and the other hormone treatments were begun after the birds had been under the influence of estrogen to simulate as closely as possible normal development of the oviducts of laying hens. To correlate changes in morphology and albumen secretion occurring in the oviducts of these pullets with those occurring in the oviducts of the treated immature pullets, the oviduct histology of normal, untreated White Leghorn pullets, 80 through 150 days of age, was studied. Chickens secrete estrogen, androgen, and presumably progesterone, hence these 3 hormones were used separately and in combination. When given separately, estrogen, androgen, and progesterone produced statistically significant increases of the oviduct corresponding to hormone dose. Estrogen, when injected alone, produced an increment in oviduct wt. of 4100% above the oviduct wt. of untreated controls. The increases caused by androgen or progesterone alone, even at the highest dosage levels, were only 200-300% above the oviduct wt. of controls. In producing these increases, estrogen alone caused structural changes resembling those which occur in the oviduct of the pullet entering puberty. Estrogen alone could cause the muscularis and the glandularis to differentiate typically. It increased the thickness of the smooth musculature and caused the epithelium to invaginate normally and to form tubular glands in the corium of any one fold of the magnum. The graded dose-weight response of the oviduct produced by progesterone is considered remarkable; sensitive tests of the mammalian genital tract indicate an all-or-none response. Morphological changes in the structure of the oviduct are attributable to estrogen. In the normally maturing oviduct of growing pullets, these changes are the first to occur. Thus apparently estrogen prepares the oviduct for subsequent secretory activity. When estrogen implants were used to prime the oviduct of the prepuberal pullet, injns. of androgen or progesterone produced a synergistic effect causing the increment of weight to exceed increases in weight produced by estrogen alone (e.g., ca. 8300% vs. 1300%). Estrogen alone did not induce the formation of albumen granules. Either androgen or progesterone following estrogen priming caused copious granulation in, and albumen secretion by, the tubular glands. In the normally maturing pullet, prior to the onset of laying, these functional changes are preceded by morph. changes. Studies of the histological correlatives of the magna of puberal pullets and hormone-treated immature pullets indicated that albumen secretion in the oviduct is attributable to one or both of the other sex hormones acting synergistically with estrogen. The sequence of events leading to the changes in the structure (e.g., epithelial height, thickness of smooth musculature and presence of cilia) and function (e.g., presence of granules in the tubular gland cells and secretion in the lumen of the ducts) in the 3 regions of the magnum varied. After 120 days of age, development in any one region appeared to be chiefly quantitative. These results are in agreement with those obtained in mammals, in which secretory activity of uterine endometria and of mammary glands, requires the

action of estrogen and progestin. Apparently estrogen is primarily concerned with inducing morph. changes in the magnum of the oviduct of the puberal pullet, while one or both of the other sex hormones are concerned with inducing the secretory changes.—Courtesy Dissertation Absts.

BRUNSON, CLAYTON C., and GEORGE F. GODFREY. (Oklahoma Agric. Expt. Sta., Stillwater.)
THE RELATIONSHIP OF EGG SHAPE, EGG WEIGHT, SPECIFIC GRAVITY, and 21-DAY INCUBATION WEIGHT-LOSS TO HATCHABILITY OF BROAD-BREASTED BRONZE TURKEY EGGS. *Poultry Sci. 32:* 846-849. 1953.—In studies involving 1534 eggs laid by Broad-Breasted Bronze turkeys, no relationship between egg shape and hatchability was evident except that very long, narrow eggs and very round eggs did not hatch as well as those closer to "normal" egg shape; eggs of about avg. size hatched better than extremely small or large eggs; and no significant relationship was found between specific gravity and 21-day incubation weight-loss and hatchability.—*Auth. summ.* (Biological Abstracts)

CARSON, J. R., and W. A. JUNNILA. (U. Connecticut, Storrs.)
ULTRAVIOLET IRRADIATION OF THE TURKEY HEN. *Poultry Sci. 31:* 871-873. 1953.—Increased egg production resulted when confined Broadbreasted Bronze turkey pullets were irradiated for 14 hrs. daily with a combination of antirachitic u.-v. energy and incandescent light. Similar increases were not obtained by treatment with either of the above radiant energies alone.—*Auth. summ.* (Biological Abstracts)

CLEGG, ROBERT E., and R. E. HEIN. (Kansas State Coll., Manhattan.)
LACK OF CORRELATION BETWEEN VARIATION IN THE AMOUNT OF CALCIUM AND SERUM ALBUMIN IN THE BLOOD SERA OF CHICKS. *Poultry Sci. 32:* 867-870. 1953.—Evidence indicating the nondependence of variation in the serum Ca on fluctuations in the serum Ca is presented. Injection of diethylstilbestrol caused the serum Ca to rise sharply, whereas the albumin concn. did not show such variation. By employing chicks from 0. to 4 weeks of age, the rise in the albumin with age was not reflected in a rise in the serum Ca.—*R. E. Clegg.* (Biological Abstracts)

DAM, H., and E. SONDERGAARD. (Polytechnic Inst., Copenhagen, Denmark.)
FASTER ACTION OF VITAMIN K_1 THAN OF MENADIONE AND SYNKAVIT INTRAVENOUSLY INJECTED INTO VITAMIN K-DEFICIENT CHICKS. *Experientia 9(1):* 26-27. 1953.—The actions of intraven. injected vit. K_1, methylnaphthoquinone and Synkayvite were compared in vit. K-deficient chicks. During the first hrs. vit. K_1 acts much faster in decreasing the prothrombin time than the other compounds.—*J. Lever.* (Biological Abstracts)

HENDERSON, E. W. (Michigan State Coll., E. Lansing.)
GROWTH OF TWELVE-WEEK-OLD CHICKENS NOT AFFECTED BY SIZE OF EGGS. *Michigan State Coll. Agric. Expt. Sta. Quart. Bul. 35:* 436-439. 1953.—Correlation coeffs. were calculated between the wt. of 355 eggs of 3 purebreds and 3 crossbreds and the 12th week wt. of broiler chickens grown therefrom. Egg wt. among 7 sample lots of males and 7 sample lots of females varied from 48 to 71 g. Broiler wt. varied from 1.6 to 3.5 lbs. among females and 1.8 to 4.2 lbs. among males. Coeffs. of correlation varied from +.36 to −.17 among the 14 sample lots. None was significant statistically.—*E. W. Henderson.* (Biological Abstracts)

HUSTON, T. M., and A. V. NALBANDOV. (U. Illinois, Urbana.)
NEUROHUMORAL CONTROL OF THE PITUITARY IN THE FOWL. *Endocrinology 52:* 149-156. 1953.—The presence of an irritant, such as a loop of thread, in the magnum portion of the oviduct of laying

hens, completely suppresses ovulation in the great majority of treated animals. There is no reduction in size of ovary, oviduct or comb of these hens for as long as 25 days. Injn. of progesterone or of gonadotropin containing LH into such hens causes ovulations but only so long as the injns. are continued. Presence of an irritant is thought to prevent secretion of amts. of LH sufficient to cause ovulation (ovulatory peaks), but does not interfere with secretion of levels of LH sufficient to assure normal androgen secretion, as is evidenced by the fact that in hens with a thread in the oviduct the comb does not decrease in size. The presence of the loop does not prevent secretion of normal amts. of FSH since the ovary remains of normal size for as long as 25 days after the operation. For approx. the same length of time the ovary also contains follicles of ovulatory size (30 mm. or over) and in the same numbers as would be expected in unoperated hens. These follicles continue to secrete estrogen at normal levels since the oviduct in operated hens does not decrease in size and remains capable of secreting albumen. This neurogenic system may be of physiological importance in the normal hen in that it may serve to synchronize ovulation with the other events of the laying cycle.—*Auth. summ.* (Biological Abstracts)

HUTCHINSON, J. C. D. (Poultry Res. Centre, Edinburgh.)
EFFECT OF HOT CLIMATE ON EGG WEIGHT. *Poultry Sci. 32:* 692-696. 1953.—Short daily exposures of 107-214 min. to environmental temps. of 99-104°F. reduced the egg wt. of hens. This reduction was greater than when the birds lived continuously in an environmental temp. of 85°, or one of 90°F. during the day and 80°F. at night.—*J. C. D. Hutchinson.* (Biological Abstracts)

KAPLAN, J. GORDIN, and M. J. FRASER. (Dalhousie U., Halifax, N. S., Canada.)
THE EFFECT OF ULTRAVIOLET RADIATION ON MONOMOLECULAR FILMS OF EGG ALBUMIN. *Biochem. et Biophys. Acta 9:* 585-596. 1952.—Films were maintained at constant pressure while changes in area were followed, correcting for spontaneous expansion of unirradiated control films. During the 1st quarter-hr. of irradiation, the area of films spread on salt substratum increased, while that of those spread on distilled water underwent no change despite modification of certain other properties of the film molecules. Thereafter, the area of the irradiated monolayers decreased at a remarkably regular rate, that for the films on saline being almost twice that for films on distilled water. The decrease in area was not simply due to elimination of destroyed protein from the film, since the properties of the residual film molecules, as determined by analysis of force-area curves, were strikingly different from those of the unirradiated films. The end result of the irradiation is a photochemical proteolysis yielding small, soluble, non-surface-active fragments. Initially, a non-proteolytic structural change resulting in fur- their unfolding of the already extended film molecules is believed to occur.—*Authors.* (Biological Abstracts)

MATSUO SHINICHI. (U. Kyushu, Japan.)
STUDIES ON THE MORPHOLOGY OF THE ADRENAL CORTICAL CELLS IN THE FOWL. [In Japanese with English summ.] *Sci. Bull. Fac. Agric. Kyushu Univ. 13(14):* 388-391. Illus. 1951.—Two types of the cells (pale cell and fuchsinophile cell) were found in the adrenal cortical cells of the fowl as already reported by Uotila. Contrary to the Uotila suggestion that the pale cells are precursors of active fuchsinophile cells, the author supposes that both cell types are distinctly different.—*Auth. summ.* (Biological Abstracts)

MURRAY, HAZEL C., and MORTON M. ROSENBERG. (U. Hawaii, Honolulu.)
STUDIES ON BLOOD SUGAR AND GLYCOGEN LEVELS IN CHICKENS. *Poultry Sci. 32:* 805-811. 1953.—The normal sugar concn. of venous blood from mature New Hampshire pullets was found to be 182.5 mg. %. When they were fasted, the blood sugar levels dropped and, after 3 hrs. stabilized at a significantly lower plateau. No significant change occurred in blood sugar levels from birds fasted 3-16 hrs. When

pullets starved 16 hrs. were returned to a practical type layer ration, the blood sugar level returned to normal within 1 hr. No detectable remained in the livers of 6-week-old New Hampshire cockerels following 16 hrs. of fast. When they were fed cracked yellow corn, the liver glycogen concn. increased hourly to 7 hrs. on feed. At that time the avg. glycogen content of 12 cockerels was 6.07%. Other cockerels concurrently fasted and then fed low-grade sugar showed a faster glycogen deposition. After 7 hrs. on this sugar, 12 cockerels had an avg. liver glycogen concn. of 7.75%. Whereas cockerels fed cracked yellow corn 8-10 hrs. following fasting showed no further rise in liver glycogen, those fed low-grade sugar continued to deposit greater concns. of glycogen. After 10 hrs. on feed, 9 cockerels had an avk. concn. of 10.33% liver glycogen. The breast muscle glycogen content of 6-week-old cockerels fasted 16 hrs. was low (0.05%), and the lower thigh muscles from the same birds contained practically none (0.01%). When 90 cockerels were fasted 16 hours and then fed cracked yellow corn for 1 to 10 hrs., the avg. analysis of breast muscles was 0.33% glycogen while that of the lower thigh muscles was 0.23%. Comparable avg. values from a group treated similarly but fed low-grade sugar was 0.32% glycogen for breast muscles and 0.24% for lower thigh muscles.—*M. M. Rosenberg.* (Biological Abstracts)

OLSEN, M. W., and S. J. MARSDEN. (Bureau Animal Indust., Beltsville, Md.)

EMBRYONIC DEVELOPMENT IN TURKEY EGGS LAID 60-224 DAYS FOLLOWING REMOVAL OF MALES. *Proc. Soc. Exptl. Biol. and Med. 82:* 638-641. 1953.—A retarded type of embryonic development occurred in 16.7% of the Beltsville Small White turkey eggs laid 54-224 days after the females were separated from males. This development in most instances could not be detected macroscopically earlier than the 4th day of incubation. The embryonic membranes usually discontinued their growth after covering an area of the yolk equal to that occupied by a normal 2- to 3-day turkey embryo. In most instances no embryo could be detected macroscopically although serial cross sections showed an organization on the part of centrally located cells. Two living embryos were found in eggs laid 78 and 98 days, respectively, after the hens were separated from the males. These embryos, after 8 days of incubation, had attaind a size equivalent to a normal 4-day turkey embryo. A 7-day embryo, with a well-developed vascular system was also found in an egg which had been incubated 11 days. This egg was laid 195 days after the female had been separated from males.—*M. W. Olsen.* (Biological Abstracts)

PINO, JOHN A., and C. B. HUDSON. (Rutgers U., New Brunswick, N. J.)

DURATION OF SEXUAL RETARDATION IN S.C. WHITE LEGHORN PULLETS AND COCKERELS FOLLOWING ENHEPTIN (2-AMINO, 5-NITROTHIAZOLE) FEEDING. *Poultry Sci. 33:* 650-655. 1953.—Pullets 13 weeks of age and cockerels 12 weeks of age were given Enheptin (2-amino, 5-nitrothiazole) in the diet for 3 weeks. Pullets receiving continuous low levels of drug (.05%) showed complete sexual suppression during treatment. Control pullets began production at 22 weeks of age while pullets drug treated for 3 weeks (first 2 weeks drug level 0.1%, 3d week 0.05%) began production at 27 weeks of age. Cockerels (drug level 0.1% for 2 weeks, 0.05% in the 3d wek) showed sexual suppression for 10 weeks after discontinuance of treatment as shown by testis histology, sexual behavior and secondary sexual characters.—*J. A. Pino.* (Biological Abstracts)

SCHWENK, ERWIN, and CYRIL F. BAKER. (Worcester Found. Exptl. Biol., Shrewsbury, Mass.)

STUDIES ON THE BIO-SYNTHESIS OF CHOLESTEROL. V. C^{14}-CHOLESTEROL IN THE EGG YOLK AND IN THE LAYING HEN. *Arch. Biochem. and Biophys. 45:* 341-348. 1953—Admn. of carboxyl labelled acetate to hens causes formation of C^{14}-cholesterol, accompanied by higher counting substances (HCC). Yields of cholesterol are higher when the acetate is given in subdivided doses. HCC_{14} pass into the feces. Even 90 days after admn. of acetate, C^{14}-cholesterol is present

in the animal. No HCC are then found. In the egg, HCC are replaced by material which is lower counting or not radioactive.—*Authors.* (Biological Abstracts)

SYKES, A. H. (Poultry Res. Centre, Edinburgh.)
SOME OBSERVATIONS ON OVIPOSITION IN THE FOWL. *Quart. Jour. Exptl. Psysiol. 38:* 61-68. 1953.—Spinal cord transection did not prevent oviposition in 6 out of 9 hens but the process took much longer than usual and subsequent ovulation was almost entirely inhibited in all the birds. Observations at laparotomy showed that the uterus was not everted during oviposition but that the egg was laid by the peristaltic action of the vaginal muscles probably helped by the abdominal muscles.—*A. H. Sykes.* (Biological Abstracts)

WATERHOUSE, D. F.
STUDIES ON THE DIGESTION OF WOOL BY INSECTS. IX. SOME FEATURES OF DIGESTION IN CHEWING LICE (MALLOPHAGA) FROM BIRD AND MAMMALIAN HOSTS. *Australian Jour. Biol. Sci. 6:* 257-275. 1953.—Some aspects of digestion in 8 spp. of Mallophaga infecting birds and mammals were examined. The anatomy and histology of the alimentary canal are descr. and the relatively poor tracheation of the crop and mid-gut recorded. The bird-infesting spp. all regularly ingest feather particles and the poultry body louse in addition obtains fresh blood from its host. In these spp. the food in the crop is subjected to the action of digestive juices passed forward at regular intervals from the midgut and, as a consequence, the pH (about 8.0) and oxidation-reduction potential (about—200 mV.) of both of these regions is the same. The presence of a comb of teeth at the posterior end of the crop in *Amblycera* and the arrangement of the inlet and outlet of the crop in *Ischnocera* prevent the passage of most intact feather particles into the midgut, which receives partially digested material with disorganized structure. Free sulfhydryl groups can be detected in the crop and midgut, and the ingestion of cobalt-impregnated feathers results in the formation of a characteristic brown, cobaltic-cysteine complex. Metallic sulfides are not produced, indicating that, as in dermestid larvae, the cystine of feather keratin is reduced to cysteine, but that further breakdown to hydrogen sulfide which is characteristic of the clothes moth larva, *Tineola)* does not occur. Neither hair nor wool could be detected regularly in the digestive tract of the mammal-infesting spp. examined, which instead appear to ingest mainly epithelial debris and skin secretions. In the sheep louse *Damalinia ovis,* the slightly acid (pH 6.5), oxidizing (greater than +77 mV.) midgut digestive juices are not passed regularly into the crop. Free sulfhydral groups could not be detected and it is doubtful if wool would be digested during passage through the alimentary canal.—*Auth. summ.* (Biological Abstracts)

YAMASHINA, YOSHIMARO.
STUDIES OF THE ELIMINATION OF BROODINESS IN DOMESTIC FOWL BY THE USE OF PROLACTIN. (I). [In Japanese with English summ.] *Misc. Repts. Yawashina Inst. Ornithol. and Zool. 1.* 2-4. 1952.—This is a preliminary report on the broodiness in F_1 chickens derived from various crosses between cocks and hens of the Plymouth Rock fowl. Broodiness in the cocks was detd. by their reaction to prolactin injns.; that of the hens by trap-nest method. The chicks were hatched in May, 1951, and 12 of the pullets began to lay that autumn. Observations made from then until the autumn of 1952 gave the following results; 3 F_1 females from the cross between a non-broody cock and a non-broody hen showed no broodiness; 2 F_1 females from the cross between a non-broody cock and a slightly broody hen showed no broodiness; of 3 F_1 females from the cross between the same non-broody cock and a strongly broody hen, one showed broodiness, 2 did not; 3 F_1 females from the cross between a broody cock and a broody hen all showed broodiness. These results seem to indicate that the effect of prolactin injns. parallels the genic constitution of the cocks in regard to broodiness, and that prolactin may be of use in eliminating broodiness from the strains of domestic fowl.—*Auth. summ.* (Biological Abstracts)

NUTRITION

ALMQUIST, H. J., and J. B. MERRITT. (The Grange Co., Modesto, Calif.) THE VALUE OF ANTIBIOTIC SUPPLEMENTS FOR GROWTH AND FEED CONVERSION IN DIETS FOR GROWING TURKEYS. *Poultry Sci. 32:* 878-880. 1953.—Five male and 5 female groups of Beltsville Small White poults, approx. 400 per group, were started and grown on practical mashes containing 5 g. of aureomycin per ton, an amt. previously found to be optimal for this antibiotic. Diamine penicillin equivalent to 2 g. of penicillin G per ton was added or removed from these mashes during one or more of three growing periods. The penicillin supplement proved beneficial to toms in respect to both gain and feed-gain ratio in all 3 age periods. Hens were improved in gain or feed-gain ratio, or both, in all age periods. On withdrawal of the penicillin supplement, the birds reverted to gains and feed-gain ratios similar to those of control groups having no penicillin in feed. It is evident that an effective antibiotic is required for maximal results in all growing age periods of the turkey.—*H. J. Almquist.* (Biological Abstracts)

ALMQUIST, H. J., and J. B. MERRITT. (The Grange Co., Modesto.) EFFECT OF CRYSTALLINE TRYPSIN ON THE RAW SOYBEAN GROWTH INHIBITOR. *Proc. Soc. Exptl. Biol. and Med. 83:* 269. 1953.—Crystalline trypsin, added to chick diets which contained 5% of protein furnished as raw soybean meal and 15% as cooked soybean meal, improved the rate of gain of the chicks. The effect is attributed to inactivation, at least in part, of the anti-trypsin present in the raw soybean meal.—*Authors.* (Biological Abstracts)

ARSCOTT, G. H., and G. F. COMBS. (U. Maryland, College Park.) FURTHER EVIDENCE OF AN UNIDENTIFIED HATCHABILITY FACTOR IN CONDENSED FISH SOLUBLES. *Poultry Sci. 32:* 730-733. 1953.—Evidence has been presented for the presence of an unidentified dietary essential in condensed fish solubles which is required for normal hatchability of fertile eggs by New Hampshire pullets fed a practical-type ration containing adequate amts. of known nutrients including vitamin B_{12}. Differences in hatchability were noted with pullets housed on wire floors and on litter. The improvement in hatchability observed with rations containing fish solubles was more pronounced in pullets housed on wire flors, as compared with those maintained on litter, indicating that the incidence of coprophagy may greatly influence the amt. of the factor required in the ration.—*Authors.* (Biological Abstracts)

BALDINI, JAMES T., ROY E. ROBERTS, and CHARLES M. KIRKPATRICK. (Purdue U., Lafayette, Ind.) ANTIBIOTIC AND VITAMIN B_{12} SUPPLEMENTS AS RELATED TO THE CRUDE PROTEIN LEVEL OF BOBWHITE QUAIL DIETS. *Poultry Sci: 32:* 563-567. 1953.—In each of 2 expts., 6 lots of 35-day-old bobwhite quail chicks were reared to 6 wks. of age in battery brooders. The basal all-mash ration contained approx. 95% of a mixture of corn and soybean oil meal supplemented with minerals, with vitamins A, D, riboflavin, choline, and niacin, and with 0.25% methionine. In one expt. rations with 22, 25, or 28% protein were fed to 2 lots. To the ration for one lot on each protein level was added 1.5% (dry basis) of condensed fish solubles. In the other expt. rations with 20, 24, or 28% protein were fed to 2 lots. One lot on each protein level received 0.5% of an antibiotic and vitamin B_{12} supplement (1.8 g. aureomycin and 1.8 mg. vitamin B_{12} per lb.). Growth was not improved by either condensed fish solubles or the antibiotic and B_{12} supplement, or a combination of the two, when the ration contained 24 or 28% protein. However, the addition of fish solubles to the 20% protein ration improved growth and livability. The use of the antibiotic and B_{12} supplement, in addition to fish solubles, resulted in further improvement so that the 20% protein ration produced growth equal to that obtained on the 28% protein ration. The antibiotic and B_{12} supplement resulted in more efficient utilization of feed and also of protein at all 3 levels of protein, but this

improvement was greatest at the 20% protein level.—*R. E. Roberts.* (Biological Abstracts)

BLETNER, J. K., T. B. CLARK, C. E. WEAKLEY, JR., and A. H. VANLANDINGHAM. (West Virginia U., Morgantown.)
THE EFFECT OF SULFAQUINOXALINE IN DIFFERENT RATION FORMULATIONS ON GROWTH AND FEED EFFICIENCY OF COCCIDIA-FREE CHICKS. *Poultry Sci. 32:* 733-739. 1953.—Two- or 3-week-old, coccidia-free, New Hampshire cockerel chicks were fed varying levels of sulfaquinoxaline in different ration formulations for 28 days. Two of the levels, 0.00625% and 0.0125%, did not affect either growth or feed utilization. The therapeutic level of the drug, 0.05%, fed continuously instead of intermittently, as recommended, gave inconsistent results indicating that continuous feeding at this level may be slightly toxic in certain rations. Observation on exptl. technics emphasize the importance of sufficient replicate lots and of exptl. design in minimizing the effect of variability due to unexplained locational differences. Fasting exptl. chicks for 12 hrs. before weighing did not reduce the coeff. of variability of the wt. gains or alter the conclusions.—*J. K. Bletner.* (Biological Abstracts)

BOSE, S., B. M. THAKRAL, and S. NARAYANAN. (Indian Vet. Res. Inst. Izatnagar.)
THE UTILIZATION OF MANGO-SEED KERNEL AND JAMAN SEED MEAL IN A SIMPLIFIED POULTRY RATION FOR GROWING CHICKEN. *Indian Jour. Vet. Sci. and Animal Husbandry 22:* 247-250. 1952.—Replacement of 20 parts of yellow maize meal by mango-seed kernel and Jaman seed meal in the ration of chicks had no detrimental effect on the growth rate, food consumption, or food utilization.—*N. N. Dastur.* (Biological Abstracts)

BRIGGS, G. M., E. G. HILL, and T. H. CANFIELD. (U. Minnesota, St. Paul.)
THE NEED FOR CHOLINE, FOLIC ACID, AND NICOTINIC ACID BY GOSLINGS FED PURIFIED DIETS. *Poultry Sci. 32:* 678-680. 1953.—Choline, folic acid, and nicotinic acid are needed by the gosling for optimum wt. gains during the first 2 weeks and for the prevention of mortality. Folic acid-deficient geese show a cervical paralysis cured by injns. of pterolyglutamic acid. Nicotinic acid- and choline-deficient geese show a leg paralysis, perhaps related to perosis.—*Authors.* (Biological Abstracts)

BROWN, J. A., A. R. ROBBLEE, and D. R. CLANDININ. (U. Alberta, Edmonton, Canada.)
THE USE OF PENICILLIN IN BREEDING RATIONS. *Poultry Sci. 32:* 576-578. 1953.—In a trial lasting for 336 days, addition of penicillin to 3 practical-type breeding rations, which varied in protein or energy level, had no effect on rate of production, feed efficiency or avg. body wt., on fertility and hatchability of eggs produced, nor on the liver storage of riboflavin.—*From auth. summ.* (Biological Abstracts)

CARD, PAUL O.
PALATABILITY IS IMPORTANT TO SUCCESS OF FEEDING OPERATIONS. *Western Feed and Seed 8(5):* 58, 70. 1953.—Fatty acids and rancidity are 2 causes of unpleasant flavor.—*J. F. Harrington.* (Biological Abstracts)

CARVER, DONALD S., and ELTON L. JOHNSON. (Iowa State Coll., Ames.)
UNIDENTIFIED GROWTH FACTORS FOR THE CHICK IN VEGETABLE OILS AND FATTY ACID CONCENTRATES. *Poultry Sci. 32:* 701-705. 1953.—The chick requires factors present in unsaturated fats for maximum growth. Livability was normal, however, with the fat-free soybean protein basal diet. Crude corn oil, refined corn oil, soybean oil, wheat germ oil, and oleic acid concentrate and linoleic acid concentrate stimulated chick growth. Wheat germ oil and oleic acid concentrate

appeared to contain greater quantities of the factors as they were superior to the other oils in stimulating growth. These results were obtained with chicks receiving a semi-purified diet containing all known nutrients at levels exceeding recommended allowances.—*E. L. Johnson.* (Biological Abstracts)

COMBS, G. F. (U. Maryland, College Park.)
UNIDENTIFIED FACTORS FOR POULTRY. *World's Poultry Sci. Jour. 9:* 93-96. 1953.—A dried whey product, fish meal, liver, dried brewer's yeast, crab meal, and butyl fermentation solubles, contain probably at least 2 unidentified chick growth factors. Addition of certain antibiotics reduces but does not eliminate need for these factors. Liver and fish solubles contain an unidentified factor for hatchability.—*J. B. Christiansen.* (Biological Abstracts)

COUCH, J. R. (Texas A. and M. Coll., College Station.)
INCREASING GROWTH AND IMPROVING FEED EFFICIENCY BY ADDITION OF METHIONINE. *Amer. Miller and Processor 81(7):* 44-45. 1953.—Addition of methionine, especially when fed in the presence of fish meal or fish solubles, dried whey and other sources of unidentified growth factors, produces a significant increase in the growth of birds. Growth tests showed that feed containing added methionine produced 20 lbs. more broilers per ton of feed than the control feed not containing the added amino acid.—*H. G. Obermeyer.* (Biological Abstracts)

DELAPLANE, J. P. (Texas A. and M. College, College Station.)
NUTRITION AND POULTRY DISEASES. *Flour and Feed 54(2):* 16-17. 1953.—There are no clearly recognized relationships between poultry nutrition and the common infectious diseases such as coccidiosis, blackhead, fowl cholera, typhoid, etc. Chemotherapeutic agents, especially sulfonamides and specific antibiotics, are the only means known to be effective in the control of these diseases.—*M. J. Blish.* (Biological Abstracts)

DOCTOR, V. M., B. E. WELCH, R. W. PERRETT, C. L. BROWN, SABIT GABAY, and J. R. COUCH. (Texas Agric Expt. Sta., College Station.)
METABOLIC INTERRELATIONSHIP BETWEEN VITAMIN B_{12}, FOLIC ACID AND THE CITROVORUM FACTOR. *Proc. Soc. Exptl. Biol. and Med. 84:* 29-32. 1953.—Supplementing a low vit. B_{12}-folic acid (PGA) chick diet with either increasing levels of vit. B_{12} (30 γ and 500 γ/kg.) or increasing levels of PGA (2, 100, and 400 mg./kg.) resulted in an increased capacity by the liver homogenates to transform added PGA to citrovorum factor (CF). Also homogenates of liver from chicks receiving 400 mg. PGA/kg. of diet gave an increase in PGA to CF conversion which was comparable to supplementation of the diet with 500 γ vit. B_{12}/kg. This would suggest that the 2 vits. may influence the converting enzyme system by separate pathways. Up to the present time the nature of the enzyme system concerned in the conversion of PGA to CF is poorly understood. Since CF is 5-formyl-5,6,7,8-tetrahydropteroylglutamic acid, it was suggested that the conversion of PGA to CF may be dependent upon sources of single C fragments, such a formate and serine. In the present studies, in vitro addition of formate or vit. B_{12} to the liver homogenate gave only a slight stimulation of PGA to CF conversion by the liver homogenate.—*V. M. Doctor.* (Biological Abstracts)

EISENSTARK, A., and P. SANFORD.
THE ACTION OF ANTIBIOTICS ON INTESTINAL FLORA OF POULTRY. 1. BACTERIAL COUNTS IN CHICKENS FED VARYING LEVELS OF AUROFAC. *Poultry Sci. 32:* 837-839. 1953.—Counts were made of the intestinal flora of 6 groups of 8-week-old chicks fed different levels of Aurofac (Lederle). Media were used which would give counts for ordinary aerobic and anaerobic saprophytic bacteria, aerobic counts, lactic acid bacteria, enterococci, coliform types, and yeasts. The methods employed failed to reveal any significant change in

the intestinal flora following the feeding of aureomycin.—*A. Eisenstark.* (Biological Abstracts)

EISENSTARK, A., and R. D. DRAGSDORF.
THE ACTION OF ANTIBIOTICS ON INTESTINAL FLORA OF POULTRY. 2. EFFECT ON THE GROWTH OF INTESTINAL BACTERIA IN VITRO. *Poultry Sci. 32:* 740-845. 1953.—Evidence is presented that antibiotics in low concn. may have a stimulatory effect upon growth of bacteria, which may in turn be related to wt. gains in antibiotic-fed animals. Cecal filtrates from antibiotic-fed birds showed a higher degree of stimulatory power on bacteria than did cecal filtrates from control birds. Microscopic examinations of stimulated bacteria revealed numerous enlarged and filamentous cells. The relationship of the changes produced in bacteria by low antibiotic concns. to animal growth is discussed.—*A. Eisenstark.* (Biological Abstracts)

ELAM, J. F., R. L. JACOBS, and J. R. COUCH. (Texas A. and M. Coll., College Station.)
THE EFFECT OF PROLONGED FEEDING OF ANTIBIOTICS UPON THE PERFORMANCE OF LAYING HENS. *Poultry Sci. 32:* 792-795. 1953.—New Hampshire pullets were fed a practical all-vegetable protein diet (with and without vitamin B_{12}) and supplemented with penicillin, inactivated penicillin and bacitracin. Each was administered orally and parenterally to determine the effect of prolonged feeding of an antibiotic (from one day of age) on egg production and hatchability. The prolonged feeding of antibiotics resulted in increased egg production and hatchability. The parenteral administration of these antibiotics-in-water failed to increase the hatchability of eggs and to decrease the number of eggs exhibiting typical vitamin B_{12} deficiency symptoms observed in the embryos. The parenteral administration of inactivated penicillin-in-water and penicillin-in-oil increased egg production and hatchability. It is possible that the prolonged feeding of the antibiotic produced a flora in the intestinal tract which was more favorable for egg production and hatchability.—*Auth. summ.* (Biological Abstracts)

FISHER, H., E. P. SINGSEN, and L. D. MATTERSON.
THE INFLUENCE OF FEED EFFICIENCY ON THE PHOSPHORUS REQUIREMENT FOR GROWTH AND BONE CALCIFICATION IN THE CHICK. *Poultry Sci. 32:* 749-754. 1953.—The comparative requirement of P for growth and bone calcification has been studied in chicks fed high and low energy rations. Both diets were fed at levels of P ranging from 0.26 to 0.60%, with the Ca:P ratio maintained at approx. 2:1. The source of supplementary P was NaH_2PO_4. To vary the energy content, 25% of the corn meal in the high energy ration was replaced with 25% of oat huller feed. All birds on the high efficiency ration, regardless of P level, gained more rapidly than the birds on the low effciency ration. The relative P consumption per unit of gain was substantially less for the birds fed the high efficiency ration than for the birds fed the low efficiency ration, despite the fact that both rations contained the same percentages of P. Little or no growth response was obtained with increasing levels of P on either the high or low efficiency ration. A higher P level was required on the high efficiency ration for satisfactory bone calcification.—*L. D. Matterson.* (Biological Abstracts)

FLETCHER, J. L., B. F. BARRENTINE, L. J. DREESEN, J. E. HILL, and C. B. SHAWVER. (Mississippi Agric. Expt. Sta., College Station.)
THE USE OF FERROUS SULFATE TO INACTIVATE GOSSYPOL IN DIETS OF LAYING HENS. *Poultry Sci. 32:* 740-742. 1953.—Laying hens were fed a diet containing 10% cottonseed meal both with and without a supplement of 0.5% ferrous sulphate. The 10% cottonseed meal resulted in a colculated free gossypol content of 0.03% in the diet. Eggs from hens on each diet were stored for 60-150 days. Eggs from the diet without ferrous sulfate developed dark yolk discoloration. Very few eggs from the supplemented diet developed discoloration. Ferrous sulfate is believed to have inactivated the free gossypol in the diet.—*J. L. Fletcher.* (Biological Abstracts)

HANSEN, M. F., MARK G. NORRIS, and J. E. ACKERT. (Kansas State Coll., Manhattan.)
THE INFLUENCE OF AN ALL PLANT PROTEIN DIET SUPPLEMENTED WITH AUREOMYCIN AND VITAMIN B_{12} ON THE RESISTANCE OF CHICKS OF ASCARIDIA GALLI (SCHRANK). *Poultry Sci. 32:* 612-617. 1953.—A total of 374 chicks received an all-plant protein diet; half of them had their diet supplemented with 0.9 g. of aureomycin and 0.9 mg. of vitamin B_{12} per 100 lbs. of feed. Half of the chicks in each of the 2 diet groups were fed 100 ± 10 embryonated ova of *A galli*, the large intestinal roundworm of chickens. The chicks receiving the supplemented ration had the least mortality. Parasitosis, whether in the chicks receiving only basal ration or the supplemented ration, increased the mortality. Fewer chicks became infected in the supplemented group than in the non-supplemented group. The chicks fed the supplemented diet harbored the fewest worms. There were no statistically significant differences in the lengths of the worms recovered from the 2 exptl. groups. There was no significant difference in wt. gains between the parasitized-versus the non-parasitized chicks fed the basal ration only, whereas, those chicks given the supplemented diet and parasitized made significantly inferior wt. gains as compared with their non-parasitized controls. If poultrymen are to achieve maximum growth benefits in their flocks from feeds fortified with growth promoting substances, they should control ascariasis in their flocks.—*Authors.* (Biological Abstracts)

HEYWANG, BURT W. (U.S. Dept. Agric., Glendale, Arizona) **and A. R. KEMMERER.** (U. Arizona, Tucson.)
THE LEVEL OF PROTEIN IN THE DIET OF GROWING NEW HAMPSHIRE CHICKENS DURING HOT WEATHER. *Poultry Sci. 32:* 781-785. 1953.—In one expt. conducted during hot weather, New Hampshire chicks were fed diets containing varying quantities of soybean oil meal to bring their total protein content to about 20.1, 22.3, 24.3, 26.5, and 28.5%. In 2 other expts. conducted during hot weather and in one conducted during cool weather, New Hampshire chicks were fed diets containing varying quantities of sardine meal and casein to bring their total protein content to about 20.3, 21.6, 24.8, 26.9, and 29.1 percent. The results indicate that the optimum level of protein for growth in a diet fed to New Hampshires during their first 10 weeks is around 24 or 25%, during both hot and cool weather.—*B. W. Heywang.* (Biological Abstracts)

HILL, C. H., R. L. BORCHERS, C. W. ACKERSON, and F. E. MUSSEHL. (U. Nebraska, Lincoln.)
STUDIES ON CHICK STIMULATION BY ALFALFA JUICE, CASEIN, AND AUREOMYCIN. *Poultry Sci. 32:* 775-779. 1953.—Chick growth was stimulated by including 5% alfalfa juice in a high-protein, corn-soybean ration. The growth stimulation also occurred when the juice was pipetted directly into the chick. Aureomycin increased chick growth 12% over the basal but only 6.4% over the basal plus alfalfa juice. Casein at a 5% level also increased chick growth on this basal and, like alfalfa juice, decreased the growth response of the chicks to aureomycin. When glucose was substituted for corn in the basal ration, neither alfalfa juice nor aureomycin increased growth but a combination of the 2 did increase chick growth.—*Authors.* (Biological Abstracts)

HILL, D. C., and H. D. BRANION. (Ontario Agric. Coll., Guelph.)
FAILURE OF VITAMIN SUPPLEMENTATION TO IMPROVE GROWTH ON DIETS HIGH IN RAW SOYBEANS. *Poultry Sci. 32:* 882. 1953.—The individual addition of pyridoxine, biotin, thiamine, niacin, riboflavin, pantothenic acid or vitamin B_{12}, at levels 20-fold the requirement, did not improve the growth rate of chicks fed, from 14 to 25 days of age, a diet containing about 50% raw soybeans. In all cases the supplemented diets resulted in lower gains than those obtained on the basal diet. Supplementation with methionine produced improved growth.—*H. Branion.* (Biological Abstracts)

HUGHES, G. PEARSON, and DUDLEY EYLES. (Grassland Res. Sta., Stratford-on-Avon, Eng.)
EXTRACTED HERBAGE LEAF PROTEIN FOR POULTRY FEEDING. III. THE DIGESTIBILITY OF THE RESIDUAL PRODUCT RESULTING FROM THE EXTRACTION OF HERBAGE LEAF PROTEIN. *Jour. Agric. Sci. 43:* 152-153. 1953.—A digestibility trial is described using sheep fed on the product remaining after the extraction of herbage leaf-protein for use as poultry feed. The material gave an analysis of 25.7% dry matter, 16.2% crude protein, 0.26% P, 1.26% K and 1.13% C. The material was of low palatability and the sheep consumed a max. 2.5 lbs. of dry matter per head daily. The avg. digestibility coeff. of the dry matter was 52.1% and that of the crude protein 57.6%. N balance detn indicated a suitable protein level. The material barely supplied sufficient K and was inadequate in P and Ca. —*R. E. Burns.* (Biological Abstracts)

JACKSON, J. T., L. J. MACHLIN, E. A. BRANDENBURGER, W. L. KELLOGG, and C. A. DENTON. (U.S. Dept. Agric., Beltsville, Md.)
RETENTION OF Co 60 LABELED VITAMIN B_{12} IN CHICKENS. *Proc. Soc. Exptl. Biol. and Med. 83:* 221-222. 1953.—Vit. B_{12}-deficient eggs were injected with 3 μg. of Co^{60} labeled vit. B_{12} and as much as 30% of the radioactivity was recovered from the chicks at 12 wks. of age. Vit. B_{12} values estimated by microbiological assay and calculated from radioactivity measurements were in general agreement up to 6 wks. of age, after which there was a decided increase in total B_{12} content of the chicks, over that calculated from radioactivity, indicating absorption of the vit. from some exogenous source.—*Authors.* (Biological Abstracts)

JACOBS, R. L., J. F. ELAM, J. H. QUISENBERRY, and J. R. COUCH. (Texas A. and M. Coll., College Station.)
DEHYDRATED ALFALFA LEAF MEAL AS A SOURCE OF VITAMINS AND UNIDENTIFIED FACTORS FOR THE MATURE FOWL. *Poultry Sci. 32:* 812-816. 1953.—72 White Leghorn hens were divided into 4 groups and fed the following all-vegetable protein diets: Basal, vitamin B_{12} (50 μg./kg.), 5% dehydrated alfalfa leaf meal, and vitamin B_{12} plus dehydrated alfalfa leaf meal. Egg production, fertility, and hatchability were recorded. Microbiological detns, were made monthly for certain B-vitamins throughout the 9 month exptl. period. Blood clotting time was run on day-old chicks obtained from each of the 4 groups at monthly intervals. Chicks from hens receiving no dehydrated alfalfa leaf meal exhibited a hemorrhagic condition and a prolonged blood clotting time, this condition was corrected by injecting water-soluble vitamin K (Na-2-methyl-1, 4-naphthoquinone diphosphate) into the egg at setting time. Addition of 5% dehydrated alfalfa leaf meal to the diet containing vitamin B_{12} increased hatchability. Fertility was increased when alfalfa leaf meal was added either in the presence or absence of vitamin B_{12}. Alfalfa leaf meal in combination with vitamin B_{12} increased the folic acid and citrovorum factor content of egg yolks but failed to increase the panothenic acid or vitamin B_{12} content. The number of embryos exhibiting vitamin B_{12} deficiency symptoms was increased by feeding alfalfa in the absence of vitamin B_{12}. Blood clotting time of day-old-chicks was reduced to normal when alfalfa was added to the hen's diet.—*R. L. Jacobs.* (Biological Abstracts)

JONES, H. L., and G. F. COMBS. (U. Maryland, College Park.)
EFFECT OF AUREOMYCIN HCl ON THE UTILIZATION OF INORGANIC NITROGEN BY THE CHICK. *Poultry Sci. 32:* 873-875. 1953.—Addition of aureomycin HCl at levels of 10 and 25 ppm. in starting rations for chicks containing 15% or 17% crude protein did not enhance the utilization of inorganic N supplied by urea, ammonium citrate or dibasic ammonium phosphate as measured by growth rate and feed efficiency. Nevertheless, aureomycin HCl overcame a depression of growth and feed efficiency which resultd from the addition of ammonium citrate or dibasic ammonium phosphate to the ration containing 15% protein.—*Authors.* (Biological Abstracts)

JOWSEY, J. R., W. F. OLIVER, W. MAW, and S. H. COMMON. (Macdonald Coll. of McGill U., Canada.)
OBSERVATIONS ON THE MINERAL METABOLISM OF PULLETS. X. THE EFFECTS OF GONADAL HORMONES ON RETENTION AND TURNOVER OF CALCIUM BY THE SKELETON. *Canadian Jour. Agric. Sci. 33:* 216-224. 1953.—Sexually immature pullets were treated during an 11-day period with (a) no hormones or (b) testosterone propionate (TST) or (c) estradiol benzoate (ODB) or (d) estradiol benzoate plus testosterone propionate (ODB+TST). Food consumption and Ca intake were the same for all birds on a given day. Ca in food less Ca in droppings Ca retention) was recorded. On the 11th and final balance day the dietary Ca was labelled by replacing the $CaCO_3$ supplement by an equal amt. of $CaCO_3$ containing radiocalcium. The results for this final day showed: (1) that ODB+TST highly significantly increased the radiocalcium retained in the skeleton, whereas TST and ODB did not; (2) that TST, ODB, or ODB+TST increased the loss of Ca from the skeleton to a highly significant degree, thus demonstrating an increased exchange of Ca in the skeleton; and (3) that ODB+TST increased the turnover of skeletal Ca over all other treatments and this to a highly significant degree; while TST appeared to increase skeletal turnover, but only with a low degree of significance ($P = 0.10$). TST did not increase net gain of Ca; ODB+TST increased net gain to a highly significant degree; and ODB significantly reduced net gain of Ca. The daily retention data for the previous 10 days show that the latter effect is explicable because of changes with time in the effects of ODB on Ca retention. A tentative hypothesis is offered to explain the marked interaction between ODB and TST in regard to Ca retention.—*R. H. Common.* (Biological Abstracts)

LIBBY, DAVID A., A. C. GROSCHKE, ROBERT JOHN EVANS, and SELMA L. BANDEMER. (Michigan State Coll., East Lansing.)
FEEDING OF ARSANILIC ACID TO PULLETS. *Michigan State Coll. Agric. Expt. Sta., Quart. Bull. 35:* 419-427. 1953.— Quantitative data on the deposition of As in eggs and tissues were obtained during a 17-wk. period. Feeding 90 or 180 g of arsanilic acid per ton did not affect body wts., egg production or hatch. Males receiving arsanilic acid lost wt. continuously but regained wt. rapidly during the following 3 wks. Arsanilic acid in the maternal diet did not affect early growth of chicks fed a practical broiler mash. Accumulation of As in eggs and tissues was well below allowable levels and was proportional to the amount incl. in the ration. As in the eggs and tissues was practically eliminated 3 wks. after discontinuance of arsanilic acid. A new method of detn. of As in eggs and tissues was devised and is reported in detail in another journal.—*D. A. Libby.* (Biological Abstracts)

LILLIE, ROBERT J., J. R. SIZEMORE, and H. R. BIRD. (U.S. Dept. Agric., Beltsville, Md.)
UNIDENTIFIED FACTORS IN POULTRY NUTRITION. I. DEVELOPMENT OF CHICK ASSAY. *Poultry Sci. 32:* 855-862. 1953.—Studies were undertaken to develop a biological assay for determining the presence of an unidentified growth factor in feeds. Results with R. I. Red and New Hampshire chicks and Beltsville Small White poults showed New Hampshire male chicks to be more sensitive to the presence of the unidentified growth factor in fish meal than females of the same breed, or R. I. Reds or turkey poults. Using New Hampshire male chicks, quantities of the unknown growth factor in feeds and fermentation by-products were measured in a 4-week test. The assay diet consisted chiefly of corn, soybean meal, alfalfa meal, butyl fermentation solubles, minerals, vitamins, 3-nitro 4-hydroxyphenol-arsonic acid and crystalline aureomycin. Assays showed fish meal, fish solubles, N. F. 2 liver fraction, meat and bone scraps, wood yeast, brewers' yeast, dried cells of *Torula utilis, Hansenula suaveolens* and *Bacillus subtilis,* dried sewage sludge, hatchery residues, and dried poultry offal to be effective in promoting growth. Dried whey product, orotic acid, a liver fraction designated Biopar "C" and dried cells of *Streptomyces olivaceus* had little effect.—*R. J. Lillie.* (Biological Abstracts)

MARCH, B., and J. BIELY. (U. British Columbia, Vancouver.)
THE EFFECT OF ASCORBIC ACID ON THE GROWTH RATE OF CHICKS. *Poultry Sci. 32:* 768-774. 1953.—In expts. to ascertain whether the feeding of ascorbic acid would affect the growth rate of chicks fed different levels of folic acid in a practical type ration, penicillin had a marked sparing action on the requirement of the chick for dietary folic acid; ascorbic acid and p-aminobenzoic acid both stimulated growth in chicks fed a natural diet deficient in folic acid; ascorbic acid and/or p-aminobenzoic acid in conjunction with penicillin stimulated growth of chicks fed diets deficient in folic acid to a greater extent than these vitamins or the antibiotic individually; and in a "complete" chick diet which was not improved by aureomycin supplementation, a combination of aureomycin and ascorbic acid stimulated growth but a combination of aureomycin and p-aminobenzoic acid had no effect.—*Authors.* (Biological Abstracts)

MATTERSON, L. D., LOIS DECKER, E. P. SINGSEN, ANNA KOZEFF, J. WADDELL, C. J. HASBROUCK, H. R. BIRD, H. MENGE, and T. D. RUNNELS.
THE VALUE OF SUPPLEMENTAL METHIONINE IN PRACTICAL CHICK STARTER AND BROILER RATIONS. *Pultry Sci. 32:* 817-826. 1953.—In a collaborative study, 4 expt. stations participating, the source of chicks and feed were constant, with environment the only major variable in a randomized block design. Statistical analyses of the data from all stations brought out the following facts:—The absolute wt. obtained with birds at the different stations on the same experimental regime varied significantly, but the relative growth response to the various exptl. treatments was the same for all stations; the presence of supplemental methionine vs. no supplemental mthionine in a chick starting ration significantly improved efficiency of feed utilization, whereas improvement as measured by growth response was variable; in the combined data, whenever fish meal was a variable, increasing the level from 0 to 2.5% very markedly improved both growth and feed efficiency; the presence of fish meal in the ration did not prevent supplemental methionine from improving feed efficiency; when chicks grown on the floor had their rations supplemented with methionine, the improvement in effciency of feed utilization was more marked than when the chicks were battery raised.—*L. D. Matterson.* (Biological Abstracts)

MENGE, H., C. A. DENTON, H. R. BIRD. (Bur. Animal Indust., Beltsville, Md.), **and G. F. COMBS.** (U. Maryland, College Park.)
EFFECT OF SUPPLEMENTAL DL-METHIONINE AND VARYING PROTEIN LEVELS ON GROWTH AND FEED REQUIREMENTS OF BROILER CHICKENS. *Poultry Sci. 32:* 827-836. 1953.—The effect of supplemental DL-methionine and change of protein level on the growth rate and the feed efficiency of broilers was studied. The data were obtained from an expt. conducted simultaneously at the Agric. Research Center and the Univ. of Maryland. Day-old sexed New Hampshire chicks (broiler strain) obtained from the same source were used. All of the feed required for the entire study (at both stations) was mixed by one mill prior to the start of the study. Three basal rations of different protein levels (22, 19 and 16%) were employed. The data show that supplemental DL-methionine was of value in improving both rate of growth and feed efficiency of broilers to 6 weeks of age at both stations. However, methionine was of no value at Beltsville during the period from 6 to 10 weeks of age, although at the Maryland station it continued to improve both the rate of growth and the feed efficiency. During this same period, a more rapid rate of growth and a more efficient feed utilization were obtained with the groups at Beltsville than those at Maryland irrespective of supplemental methionine. When the entire 10-week period is considered, supplemental methionine was of more value in improving both the rate of growth and the feed efficiency of broilers at Maryland than at the Beltsville station. This can be attributed to the fact that methionine gave a response at Maryland during the entire expt., whereas, it did not give a response during the latter part of the experiment at Beltsville. Since the chicks were obtained from the

same source and identical rations were used, it seems probable that environmental factors account for the inconsistency. The different levels of protein tested had no significant influence on the value of supplemental methionine during the period from 6 to 10 weeks of age. The data also suggest that the protein level of broiler rations may be reduced to 19% after the birds are 6 to 8 weeks of age without affecting the rate of growth or the efficiency of feed utilization.—*Henry Menge.* (Biological Abstracts)

MENGE, H., C. A. DENTON, J. R. SIZEMORE, R. J. LILLIE, and H. R. BIRD. (Bur. Animal Indust., Beltsville, Md.)
UNIDENTIFIED FACTORS IN POULTRY NUTRITION. 2. PROPERTIES AND PRELIMINARY FRACTIONATION OF A GROWTH FACTOR IN CONDENSED FISH SOLUBLES. *Poultry Sci. 32:* 863-867. 1953.—The factor is soluble in water, phenol, 50, 60, and 80% ethanol, and 70% methanol, but insoluble in ether. It is dialyzable and is stable in autoclaving from pH 2 through 11, but not at pH 1. Using this information, concentrates of the growth-promoting substance active in 0.040 to 0.055% of the diet were obtained. Neither L-lyxoflavin nor a supplementary mixture of essential amino acids simulating those present in fish solubles elicited a growth response on this diet.—*Henry Menge.* (Biological Abstracts)

NELSON, T. S., and H. M. SCOTT. (Illinois Agric. Expt. Sta., Urbana.)
NIACIN DEFICIENCY IN THE CHICK AS INFLUENCED BY ANTIBIOTICS. *Poultry Sci. 32:* 601-604. 1953.—When a semi-purified diet containing either sucrose or dextrin as the carbohydrate was supplemented with niacin (0, 15 and 50 mg./kg. diet) and fed with antibiotics (penicillin or aureomycin—20 mg./kg.) and without antibiotics, niacin-deficiency symptoms (low viability, growth, perosis) were neither accentuated nor alleviated by the presence or absence of the antibiotics. Supplementing the basal diets with 15 mg. of niacin significantly improved growth but the incidence of perosis was high, both in the presence and absence of antibiotics, irrespective of the carbohydrate fed. A further improvement in growth and a low incidence of perosis was noted when the basal diets were supplemented with 50 mg. of niacin/kg. Neither aureomycin nor penicillin stimulated chick growth when the diet was severely low in niacin (0.47 mg./kg.) .In contrast, both antibiotics significantly increased chick growth when the diets contained adequate or slightly suboptimal levels of the vitamin. This was especially true for the chicks fed the sucrose diets.—*H. M. Scott.* (Biological Abstracts)

PATRICK, HOMER. (U. Tennessee, Knoxville.)
SUPPLEMENTS FOR A "MEAT-SCRAPS" TYPE CHICK RATION. *Poultry Sci. 32:* 570-572. 1953.—The growth-promoting value of meat scraps cannot be detd. by its protein content. One of the first limiting factors in a "meat scrap" type ration is lysine. Bacitracin, penicillin, terramycin, and aureomycin increased the growth of chicks receiving the "meat scrap" type ration, but they did not obviate the need for supplementary lysine. Soybean Oil Meal and casein contain an unrecognized factor which is deficient in meat scraps.—*H. Patrick.* (Biological Abstracts)

PATRICK, HOMER. (U. Tennessee, Knoxville.)
DEFICIENCIES IN A SESAME MEAL TYPE RATION FOR CHICKS. *Poultry Sci. 32:* 744-745. 1953.—Sesame meal is deficient in lysine, vitamin B_{12} and another factor(s) found in albumin and soybean oil meal. Poor pigmentation is not always due to a lysine deficiency. A factor(s), other than lysine, found in milk albumen and soybean oil meal is required for normal pigmentation.—*H. Patrick.* (Biological Abstracts)

PEPPER, W. F., S. J. SLINGER, and I. MOTZOK. (Ontario Agric. Coll., Guelph, Canada.)
EFFECT OF AUREOMYCIN ON THE NACIN AND MANGANESE REQUIREMENTS OF CHICKS. *Poultry Sci. 32:* 656-660. 1953.—

Dietary aureomycin increased growth and improved feed efficiency with diets containing all combinations of 10, 30 and 50 ppm. of Mn and 9, 18 and 27 mg. of niacin per pound. Considering wt., feed efficiency and the incidence of perosis, the requirement for niacin was in excess of 18 mg./pound of diet and the Mn requirement was greater than 30 ppm. Aureomycin enhanced the utilization of both Mn and niacin for growth promotion and the prevention of perosis but did not appear to reduce the dietary requirement for either nutrient. Raising the Mn level from 10 to 50 ppm. resulted in a significant increase in the wt. of the small intestine and ceca. Aureomycin brought about a slight, but non-significant, increase in cecal wt. and a significant reduction in the wt. of the small intestine.—*S. J. Slinger.* (Biological Abstracts)

PETERSEN, C. F. (U. of Idaho, Moscow.)
PEAS FOR POULTRY REQUIRE METHIONINE SUPPLEMENT. *Western Feed and Seed 8(6):* 32. 1953.—Peas can replace corn-soya type rations if used as 20% of mash and 2 pounds of methionine are added to each ton of mash.—*J. F. Harrington.* (Biological Abstracts)

RENNER, RUTH, D. R. CALADININ, and A. R. ROBBLEE. (U. Alberta, Edmonton, Canada.)
ACTION OF MOISTURE ON DAMAGE DONE DURING OVER-HEATING OF SOYBEAN OIL MEAL. *Poultry Sci. 32:* 582-585. 1953. —Results of chick-feeding trials and microbiological assays for lysine, arginine and tryptophan using both acid (alkaline for tryptophan) and enzymatic hydrolysis, indicated that the deleterious effects of over-heating soybean oil meal can be partially overcome by the addition of water prior to over-heating.—*Auth. summ.* (Biological Abstracts)

ROBBLEE, A. R., and D. R. CLANDININ. (U. Alberta, Edmonton, Canada.)
THE USE OF CALCIUM PANTOTHENATE AND BIOTIN IN PRACTICAL POULT STARTERS. *Poultry Sci. 32:* 579-582. 1953.—Turkey poults fed a practical starter ration sometimes showed a disorder characterized by poor growth, high mortality, broken feathers, dermatitis, perosis, and diarrhea. Supplementing the practical starter ration with Ca pantothenate resulted in some alleviation of the symptoms in early-hatched poults but was ineffective in late-hatched poults. Additions of both Ca pantothenate and biotin to the practical starter largely prevented the disorder.—*Auth. summ.* (Biological Abstracts)

ROMOSER, G. LYNN, MARY S. SHORB, and GERALD F. COMBS. (U. Maryland, College Park.)
EFFECT OF ORALLY ADMINISTERED PENICILLIN-RESISTANT MICROORGANISMS ON GROWTH OF CHICKS. *Proc. Soc. Exptl. Biol. and Med. 83:* 17-21. 1953.—Pure cultures of *Escherichia coli* and *Aerobacter aerogenes* were grown, lyophilized, and fed to chicks as dietary supplements both in the presence and in the absence of procaine penicillin G. Little or no chick growth response was obtained when either of these organisms were added to the ration in the absence of the antibiotic. Greater gains were obtained when 10 ppm. of procaine penicillin G were fed. When viable cultures of *A. areogenes* and *E. coli* were fed in combination with penicillin, growth was further increased significantly. The effectiveness of the antibiotic in promoting chick growth was increased 64% and 80% when these organisms were added to the feed. The results obtained illustrate the influence of bacterial environment on the antibiotic growth effect and in nutritional studies.—*Authors.* (Biological Abstracts)

ROSENBERG, M. M. (U. Hawaii, Honolulu.)
A STUDY OF B-GRADE AND REFINERY B-MOLASSES IN LAYER RATIONS. *Poultry Sci. 32:* 605-612. 1953.—B-grade and refinery B-molasses premixed with bagasse pith in the ratio of 5:1 by weight, respectively, were fed in concns. of 35.5, 46.5, and 57.5% of total ration, replacing the cereal grains primarily in this study. The B-grade molasses-bagasse pith mixture may be a practical source of carbohydrates for laying chickens when fed at levels up to 35.5% of an all-vegetable ration, provided its price is low enough to compensate for its inefficiency.

The overall efficiency of the exptl. rations progressively decreased as the concn. of this new feedstuff was increased. However, viability was not adversely affected by this "sugar" mix even when it completely replaced the cereal grains. At 35.5% of total ration the refinery B-molasses-bagasse pith mixture gave results comparable to but not as good as that obtained from an equivalent concn. of the B-grade molasses-bagasse pith mixture. At the 2 higher concns. of refinery B-molasses-bagasse pith (i.e., 46.5 and 57.5% of the total ration) egg production, feed efficiency, increase in body wt., hatchability, and viability were seriously impaired.—*M. M. Rosenberg.* (Biological Abstracts)

SAXENA, HARISH C., MILDRED E. STARR, LYNN G. BLAYLOCK, J. S. CARVER and JAMES McGINNIS. (State Coll. Washington, Pullman.)

EFFECT OF DIETARY PENICILLIN ON THE EFFICIENCY OF PROTEIN UTILIZATION BY CHICKS. *Arch Biochem. and Biophys. 44:* 346-350. 1953.—The admn. of diamine penicillin to chicks fed diets containing 15, 18 and 21% protein caused a significant increase in growth and in feed efficiency at 4 weeks. The admn. of penicillin caused a slight increase in the retention of N by the chicks fed the 15% protein diet during two 7-day collection periods (2d-4th weeks); a slight increase in those receiving the 18% protein diet during the 3rd and 4th week and no effect on the N retention of those receiving the 21% protein diet. Dietary penicillin had no sparing effect on protein when this nutrient was in the diet in sufficient quantities to promote adequate growth.—*Authors.* (Biological Abstracts)

SAXENA, HARISH C., LYNN G. BLAYLOCK, J. S. CARVER, and JAMES McGINNIS. (State Coll. Washington, Pullman.)

FACTORS AFFECTING THE GROWTH RESPONSE OF TURKEYS TO ANTIBIOTICS. *Poultry Sci 32:* 788-791. 1952.—In an expt. conducted with turkey poults in which fish meal and diamine penicillin were fed alone and in combination, the greatest growth response was obtained with diamine penicillin when herring fish meal was present in the diet of poults; incorporation of fish meal in the diet resulted in a significant increase in growth which was much greater in the presence of the antibiotic than in its absence, but no added growth was obtained from levels of fish meal above 5% in the ration; and feed efficiency was increased in those diets containing fish meal, penicillin, or a combination of both, the combination producing the greatest increase.—*James McGinnis.* (Biological Abstracts)

SAXENA, H. C., L. G. BLAYLOCK, W. J. STADELMAN, J. S. CARVER, and J. McGINNIS. (State Coll. Washington, Pullman.)

EFFECT OF PENCILLIN ON GROWTH, FEED EFFICIENCY AND FATTENING OF TURKEYS. *Poultry Sci. 32:* 721-726. 1953.—An expt. was conducted to test the effect of an antibiotic on growth, feed efficiency and fattening of turkeys. Continuous supplementation of diamine penicillin at a level of 3 ppm. in the mash during the starting and developing periods significantly improved the body wt. of turkeys at 24 weeks. A greater response was obtained in males than in females. When penicillin was included in the diet only from the 8th to the 24th week, the turkeys grew more rapidly than those receiving the basal diet but not as rapidly as those which received penicillin throughout the entire exptl. period. The removal of penicillin from the diet of the turkeys at 8 weeks of age resulted in a decreased rate of growth from 8-24 weeks to nearly the rate of those fed the basal diet. In addition to the beneficial effect of penicillin on growth, the antibiotic also produced a significant increase in efficiency of feed utilization by the turkeys, and an improvement in the fat deposition by the females. On the basis of present prices, the increase in weight and feed efficiency due to feeding penicillin would more than pay for the extra cost of feeding this supplement during the entire growing period.—*L. G. Blaylock.* (Biological Abstracts)

SCOTT, M. L. (Cornell U., Ithaca, New York.)
PREVENTION OF THE ENLARGED HOCK DISORDER IN TURKEYS WITH NIACIN AND VITAMIN E. *Poultry Sci. 32:* 670-677. 1953.—In an investigation of the enlarged hock disorder in turkeys, results were obtained which showed that both niacin and vitamin E are required for the prevention of this difficulty. These vitamins were found to be effective in preventing the enlarged hock disorder during that part of the growth period from 8 to 20 weeks of age, as well as during the first 8 weeks of life. Under the exptl. conditions, approx. 20 mg. of supplemental niacin and 5 mg. of alpha-tocopheryl acetate per pound of diet prevented the development of enlarged hocks, but 2.5 mg. of alpha-tocopheryl acetate per pound was insufficient, except in the presence of butylated hydroxyanisole, a fat-soluble antioxidant, or 1% of dried brewer's yeast. The results indicated that the effects previously obtained from dried brewer's yeast in the prevention of this disorder are due to its high niacin content and its antioxidant properties.—*L. C. Norris.* (Biological Abstracts)

SHERWOOD, D. H., E. G. HILL, and H. J. SLOAN. (U. Minnesota, St. Paul.)
L-LYXOFLAVIN IN THE STARTING DIETS OF TURKEYS AND CHICKENS. *Proc. Soc. Exptl. Biol. and Med. 83:* 395-398. 1953.—L-Lyxoflavin used in a corn-soy type diet at a level of 25 or 35 mg./kg. resulted in significant growth increases for male turkey poults. Used in a purified diet for chicks there was no growth increase. Neither did orotic acid give a growth response either alone or in combination with lyxoflavin.—*Authors.* (Biological Abstracts)

SHULTZ, FRED T., C. R. GRAU, and PHYLLIS A. ZWEIGART. (U. California, Berkeley.)
VITAMIN SUPPLEMENTS AND SQUAB PRODUCTION. *Poultry Sci. 32:* 762-768. 1953.—Supplementation of a common commercial pigeon ration with riboflavin resulted in a significant increase in the number of marketable squabs brought about largely by an increase in hatchability and to lesser extent by an increase in viability of squabs. Addition of vitamin B_{12} resulted in a substantial but not statistically significant increase, partly accounted for by an increase in hatchability. Vitamins A and D, tested together, had no effect. There were no differences in squab wt. between diets.—*Auth. summ.* (Biological Abstracts)

SIZEMORE, J. R., ROBERT J. LILLIE, C. A. DENTON, and H. R. BIRD. (U.S. Dept. Agric., Beltsville, Md.)
INFLUENCE OF AUREOMYCIN IN THE CHICK DIET UPON SUBSEQUENT REPRODUCTIVE PERFORMANCE OF LAYING HENS. *Poultry Sci. 32:* 618-624. 1953.—Among range-reared Rhode Island Red pullets, those fed an aureomycin supplement were heavier throughout the growing period than were those fed no antibiotic. Feeding the antibiotic during the growing period had no effect on mortality, date of sexual maturity, mature body wt., or subsequent egg production, fertility or egg wt. Among laying birds fed a vitamin B_{12}-deficient diet, those reared on the antibiotic-supplemented diet maintained higher hatchability than those reared without antibiotic. Antibiotic in the growing diet had no such effect if a breeder diet containing ample B_{12} was fed. Crystalline aureomycin added to a vitamin B_{12}-deficient breeder diet at levels of 5 to 40 mg./kg. of diet increased hatchability. Vitamin B_{12} contents of eggs of hens fed an antibiotic either in the growing or breeder diet were no higher than those of eggs obtained from hens fed no antibiotics.—*H. R. Bird.* (Biological Abstracts)

SLINGER, S. J., W. F. PEPPER, and D. C. HILL. (Ontario Agric. Coll., Guelph.)
VALUE OF METHIONINE SUPPLEMENTATION OF CHICK AND POULT DIETS CONTAINING A HIGH PERCENTAGE OF WHEAT. *Poultry Sci. 32:* 573-575. 1953.—Chicks and poults were fed diets containing a high percentage of wheat to 10 weeks and 8 weeks, respectively. In all cases, growth and feed efficiency were satisfactory. Addition of DL-methionine to the diets resulted in a small but consis-

tent improvement in feed efficiency but not in any clearly defined effect on the avg. wts. reached by the birds.—*S. J .Slinger.* (Biological Abstracts)

SLINGER, S. J., W. F. PEPPER, A. M. MORPHET, and E. V. EVANS. (Ontario Agric. Coll., Guelph, Canada.)

EFFECT OF PENICILLIN ON THE NIACIN REQUIREMENT OF TURKEYS AND A CARRY-OVER EFFECT OF PENICILLIN FROM DAMS TO PROGENY. *Poultry Sci. 32:* 754-762. 1953.—In the presence of penicillin, the niacin requirement of Broad Breasted Bronze poults for optimum growth and the prevention of perosis at 4 weeks of age was 16.7-21.7 mg. per lb. A considerably higher level of the vitamin appeared to be necessary in the absence of penicillin. Raising the niacin content from 11.7 to 19.2 mg. per lb. of diet caused an increase in wt. at 4 weeks of age in the presence of penicillin but caused no growth response in the absence of penicillin. These results suggest that the dietary niacin requirement of poults was reduced by penicillin. The wt. of turkeys at 8 weeks of age was not significantly changed by increasing the niacin content of the diet from 11.7-19.2 mg./pound. Addition of 7.5 mg. of niacin/pound to a practical turkey growing mash which was fed along with grain from 8 to 24 weeks of age did not improve the wt. of the males but did tend to increase female weights in the presence of penicillin. Though neither niacin nor penicillin alone, at the levels used, appeared to influence the incidence of perosis, a combination of niacin and penicillin gave complete protection to 16 weeks of age and was of some benfit at 24 weeks of age. The role of penicillin in perosis prevention is probably brought about through increasing niacin utilization. Turkeys hatched from hens receiving penicillin weighed less at 8 weeks of age than those hatched from hens not fed the antibiotic. This influence was still apparent in groups fed certain diets at 24 weeks of age. In most cases, when turkeys were given free access to mash and grain from 8 to 24 weeks of age, the presence of dietary penicillin resulted in an increase in the mash: grain ratio while supplementary niacin tended to exert the opposite effect.—*S. J. Slinger.* (Biological Abstracts)

SLINGER, S. J., A. M. MORPHET, E. C. HUNT, and W. F. PEPPER. (Ontario Agric. Coll., Guelph, Canada.)

EFFECT OF PENICILLIN ON THE REPRODUCTIVE PERFORMANCE OF TURKEYS. *Poultry Sci. 32:* 660-669. 1953.—Addition of penicillin to a practical turkey-breeder diet resulted in a decrease in hatchability, egg production, egg wt. and feed consumption. The reduction in hatchability was not significant at the 5% probability point but other evidence tends to show that the antibiotic impaired hatchability. The decreases in egg production and egg wt. were not significant at the 5% probability point but when the results for egg production and egg wt. are considered together it seems evident that penicillin reduced egg production. The reduction in feed consumption brought about by the antibiotic amounted to about 5.4% and was significant at the 5% probability point. The feeding of penicillin to turkey breeders appeared to influence their performance for a considerable period of time after the treatment was discontinued.—*S. J. Slinger.* (Biological Abstracts)

SMITH, ROBERT M.

BROILER FEEDING TRIALS. *Arkansas Agric. Expt. Sta. Bull.* 529. 1-36. 1953.—Ten broiler feeding trials were conducted from 1943 through 1950. The 6125 broilers, in 64 separate exptl. groups of 54-125 chicks, were grown until 10-12 weeks of age. Feeding a 20% protein ration during the first 6 weeks and a 17% protein ration during the last 6 weeks was equal to feeding the 20% ration throughout from the standpoint of weight, feed utilization, and mortality of egg-producing Barred Plymouth Rock Strain No. 1. However, with meat-producing strains of Barred Plymouth Rocks, New Hampshires, and crosses of these strains, using the 17% protein ration during the last 6 weeks did not prove as adequate as using the 20% ration throughout. Free-choice or hand-fed methods of feeding grain proved unreliable as a means of regulating the protein level of the ration. Thyroprotein caused a significant and consistent decrease in feed efficiency at 12 weeks. Thiouracil improved the

dressed grade of broilers but had no significant influence on mean weight or feed efficiency at 12 weeks of age. Dienestrol diacetate resulted in a slight improvement in carcass grade. It had no corsistent influence on mean wt. or feed efficiency, but markedly retarded development of comb and wattles of male broilers. Neither niacin nor choline chloride additions influnced growth, feed requirement, or dressed grade. All commercial vitamin B_{12} and antibiotic supplements to the basal ration resulted in a significant and consistent increase in mean wt. and a consistent increase in feed efficiency and dressed grade. They did not, however, consistently increase mean wt. or feed efficiency over that obtained on either high energy or low energy animal protein rations. No favorable response in mean weight, feed efficiency, or dressed grade resulted from growing broilers on old litter which had been used for one 11-week feeding period. Livability was apparently not associated with any of the factors on which these feeding trials were based.—*M. L. Lavallard.* (Biological Abstracts)

TABENKIN, B., J. M. COOPERMAN, R. E. DRUCKER, and E. M. JENKINS. (Res. and Nutrition Lab., Hoffman-La Roche, Inc., Nutley, N. J.)

EFFECT OF FEEDING SEVERAL SULFONAMIDES AND RELATED COMPOUNDS ON GROWTH OF CHICKS. *Proc. Soc. Exptl. Biol. and Med. 83:* 88-91. 1953.—Young chicks maintained continuously for 6 weeks on diets containing Gantrisin (sulfisoxazole) at levels of up to 1%, were more uniform and thrifty in wt. and appearance and exceeded the controls in wt. Young chicks maintained for 6 weeks on diets containing .03% of Ro 2-0404 (4-phenyl-4-sulfanilyl-2-butanone) or from .03 - 0.3% of Ro 2-0201 (beta-phenyl-beta-sulfanilyl-propiophenone) were also thriftier and more uniform than the controls in wt. and appearance and weighed up to 15% more than the controls. Chicks were markedly retarded in their growth when fed diets containing from 0.3 to 1% of sulfamethazine, sulfadiazine, sulfanilamide, sulfaguanidine or sulfaquinoxaline.—*B. Tabenkin.* (Biological Abstracts)

TUTTLE, JOHN W., THOMAS G. CULTON, DONALD W. MacLAURY, and W. M. INSKO, JR. (Kentucky Agric. Expt. Sta., Lexington.)

SOURCES AND LEVELS OF PROTEIN IN STARTING DIETS FOR BOBWHITE QUAIL. *Poultry Sci. 32:* 627-629. 1953.—572 quail chicks were divided at one day of age into 8 groups and fed diets having different levels and sources of protein. These rations included 1 Nestler, 1 low-protein (26%), 3 medium-protein (about 31%), and 3 high-protein (35.3%) diets. The low-protein diet had soybean meal as the protein source. The medium and high protein diets had soybean meal, meat and soybean meal, and fish meal and soybean meal as protein sources. Mortality, back feathering, and wt. at 42 days were compared by analysis of variance. While the Nestler ration gave the highest mortality, no significant differences in mortality were found. Significant differences were found in percentage of barebacks although no definite trends were established. The Nestler ration gave the lowest avg. wt. at 7 weeks. When this diet was compared with the other diets, significant differences were found.—*Auth. summ.* (Biological Abstracts

WARD, H. HORACE.

THE FEEDING STUFFS INDUSTRY. HIGH ENERGY POULTRY FEEDS. *Milling* [Liverpool] *121(7):* 192. 1953.—(Paper taken from author's analytical and technical service to the National Assoc. of Corn and Agric. Merchants.) High and sustained levels of poultry production depend on the availability of suitably balanced highly digestible feeds. Requirement is for a concentrated, high protein, high energy food suitably fortified with minerals and vitamins. Cereals must be regarded as the best source of energy, and maize is the best for poultry. The several ingredients and proportions for a typical high energy ration are listed. Cost of a high quality compound is not necessarily greater than that of an ordinary ration in which the ingredients chosen may be perfectly sound but may not have the same good digestibility for poultry.—*T. R. Aitken.* (Biological Abstracts)

POULTRY PRODUCTS AND MARKETING

BALDWIN, R. R., H. A. CAMPBELL, R. THIESSEN, JR., and G. J. LORANT. (Central Lab., General Foods Corp., Hoboken, New Jersey.)
THE USE OF GLUCOSE OXIDASE IN THE PROCESSING OF FOODS WITH SPECIAL EMPHASIS ON THE DESUGARING OF EGG WHITE: *Food Technol. 7(7):* 275-282. 1953.—The deoxygenase enzyme system has found commercial appln. in the food industry. This enzyme system contains glucose oxidase and catalase, and consequently in the presence of molecular oxygen brings about the oxidation of glucose to gluconic acid. The deoxygenase enzyme system is applicable to food processing involving (a) the exhaustive removal of oxygen in the presence of an excess of glucose, and (b) the exhaustive removal of glucose in the presence of an excess of molecular oxygen. Results of experimentation and development work in applying deoxygenase to the desugaring of commercial size batches of egg white are given.—*Authors.* (Biological Abstracts)

BRANT, A. W. (U.S. Dept. Agric., Beltsville, Md.)
EGG WASHING CAN MAKE YOU OR BREAK YOU. *Amer. Egg and Poultry Rev. 15(2):* 28, 30, 32. 1953.—Reasons for washing soiled eggs and procedures for washing dirty eggs to avoid spoilage are given. —*H. G. Lindquist.* (Biological Abstracts)

BRANT, A. W., A. W. OTTE, and GILBERT CHIN.
A SURVEY OF EGG QUALITY AT TWO EGG-LAYING TESTS. *U.S. Dept. Agric. Tech. Bull.* 1066. 1-20. 1953.—Observations on egg quality were made at the Rhode Island and Georgia Egg Laying Tests during Mar. and Aug. of 1951. After the eggs had been held 3 days near 55°F. to simulate commercial conditions, those from all hens in production were opened and their albumen quality was measured in Haugh units, shell thickness was measured, and the presence or absence of blood and meat spots was noted. The albumen quality of eggs of most birds was consistent from day to day. A sample of 2 eggs per bird was usually sufficient to verify the bird's performance. Because of this consistency, the data from birds producing only one egg during the examination periods were included in pen and breed averages. The avg. albumen quality of the eggs at both Rhode Island and Georgia was 76 Haugh units in March, just 3 Haugh units below the minimum for AA quality. In Aug. the albumen quality had dropped to 68 and 71 Haugh units for Rhode Island and Georgia, respectively. In March, 44% of all eggs for the 2 tests combined were AA quality; only 22% were of this quality in Aug. There were no great differences in the avg. albumen quality for the crossbreds and the 5 breeds represented at the Tests. Within each breed and among the crossbreds there was a wide range in the pen averages of albumen quality. No breed showed an advantage or disadvantage with respect to the albumen quality of its eggs. Shell thickness of the eggs averaged 0.0146 inch in March and 0.0138 inch in Aug. for the 2 Tests combined. In March, 20.5% of all shells were 0.013 inch or less in thickness; in Aug. the percentage was 41.1. Egg breakage during marketing increases rapidly when shell thickness drops below 0.013 inch. The breeds and crosses had a very similar average of shell thickness but there was a wide range of pen averages. Approx. 45% of all eggs examined in March contained a blood or meat spot. Although uniform classification of spots is difficult, approx. 10% of the eggs contained either a blood spot or a large meat spot. There was a distinct difference between breeds in the incidence of blood and meat spots. Of the eggs from White Leghorns and crossbreds, an avg. of 32.7% contained spots as compared with 60.7% in eggs from the heavy breeds. These figures include all spots seen in the broken-out eggs, most of which would not detract from the market value of the eggs. The most significant finding relating to the incidence of blood and meat spots was the wide range among the pens of all the breeds. High producing birds had a slight tendency to produce eggs of lower quality in the Rhode Island Test, but this tendency was not apparent in the Georgia Test. There was no significant correlation between production rate and shell thickness or inci-

dence of blood meat spots in eggs; but a highly significant correlation was found between the March and August observations on the production rate and the decline in albumen quality of eggs. Evidently it may be difficult to establish lines of birds that will be high producers of eggs and maintain high albumen quality during the summer. However, a high production rate did not always result in low albumen quality.—*From auth. summ.* (Biological Abstracts)

CARLIN, AGNES FRANCES, and JOHN C. AYRES. (Iowa Agric. Expt. Sta., Ames.)
EFFECT OF THE REMOVAL OF GLUCOSE BY ENZYME TREATMENT ON THE WHIPPING PROPERTIES OF DRIED ALBUMEN. *Food Technol. 7(7):* 268-270. 1953.—An enzyme prepn. was used for production of a glucose-free dried albumen, and angel cakes were made to test the whipping properties of the rehydrated egg white. Enzyme-treated pan-dried albumen rehydrated readily and was free from objectionable odor or flavor. The rehydrated albumen was similar in the properties tested (beating time and specific gravity of meringue, pH, volume, and flavor of angel cake) whether hydrochloric or tartaric acid was used to lower the pH of the raw liquid egg white before the enzyme was added. Angel cakes made with rehydrated enzyme-treated albumen and 0.23 g. of cream of tartar in the formula compared favorably in volume and texture to control cakes. Subjective evaluation indicated that there were no significant differences in flavor between the control angel cakes (made with frozen egg white and 0.90 g. cream of tartar in the formula) and cakes made with rehydrated enzyme-treated egg white when 0.23 g. or 0.45 g. of cream of tartar was used in the formula.—*Authors.* (Biological Abstracts)

CHIN, GILBERT, and A. W. BRANT. (U.S. Dept., Agric., Beltsville, Me.)
EGG QUALITY AND AUREOMYCIN. *Poultry Sci. 32:* 875-876. 1953.—Addition of aureomycin, up to 40 ppm., in the diet of laying hens did not affect egg wt., shell thickness, albumen quality, or the size and incidence of blood and "meat" spots, when compared with eggs from hens fed the same diet without the aureomycin. Eggs were observed for these quality factors in the spring and the fall but no abnormal seasonal variations were encountered.—*Auth. summ.* (Biological Abstracts)

DRUCKREY, I. C. (Klenzade Prod., Inc., Beloit, Wis.)
EGG WASHING TECHNIQUES. *Amer. Egg and Poultry Rev. 15(2):* 40, 42, 46, 48, 54-55. 1953.—Results are given in 2 charts and 7 graphs. A wire basket for dipping the eggs and 3 commercial machines were used in this study. The use of water, detergent solns., and detergent solns. plus quaternary were investigated. Best results in maintaining egg quality were obtained when alkaline detergents incorporating effective quaternaries were used. Washed eggs, even though special attention was paid to time, temps., and sanitizing agents used, showed a much higher loss and quality decline in storage than clean eggs.—*H. G. Lindquist.* (Biological Abstracts)

ERASMUS, J. E., and C. R. LIEBENBERG.
WEIGHT LOSSES IN TABLE POULTRY. *Farming in S. Africa 27(314):* 295-297, 1952.—Black Australorps, White Leghorns and Light Suussex and crosses between these breeds were placed in fattening coops at 12, 16 and 20 weeks, respectively, and 3 birds from each mating killed weekly. In the slaughter process the wt. loss in both males and females was greater in the lightest than the heaviest bird. In cocks, age had no significant influence on the slaughter wt. losses; in hens the slaughter wt. losses decreased as the age increased from 12 to 16 weeks. Fattening periods of 2-3 weeks showed no difference in slaughter wt. losses. The Light Sussex had on the avg, less feathers than any of the other purebreds or crosses. In females the wt. of feathers per unit wt. of body exceeded that of males. Differences in the losses in blood between the sexes were attributed to larger quantities of fatty tissues in females. (Biological Abstracts)

EVANS, ROBERT JOHN, SELMA L. BANDEMER, DAVID A. LIBBY, and A. C. GROSCHKE. (Michigan State Coll., East Lansing.)
THE ARSENIC CONTENT OF EGGS FROM HENS FED ARSANILIC ACID. *Poultry Sci. 32:* 743-744. 1953.—Three groups of 20 R. I. Red pullets were fed an all mash breeder diet containing 0, 90, and 180 g. of arsanilic acid per ton of feed. The As content of eggs from these hens was detd. before, during, and after arsanilic acid feeding. Very little As was found in eggs from hens that received no arsanilic acid. The As content of the eggs depended on the level of arsanilic acid in the diet. The longer the hens received arsanilic acid in the diet, the less arsenic they put in the eggs. Within 2 weeks after arsanilic acid feeding was discontinued the As content of the eggs was negligible. The largest amt. in the eggs was 0.5 ppm. As_2O_3.—*R. J. Evans.* (Biological Abstracts)

EVANS, ROBERT JOHN, J. A. DAVIDSON, DORIS BAUER, and HELEN A. BUTTS, (Michigan State Coll., East Lansing.)
THE BIOTIN CONTENT OF FRESH AND STORED SHELL EGGS. *Poultry Sci. 32:* 680-683. 1953.—Eggs from White Leghorn hens kept in individual laying cages were assayed for biotin with *Lactobacillus arabinosus* after preliminary digestion with 4 N H_2SO_4. Fresh eggs and eggs from each hen stored at 0°C. for 3, 7, and 12 mos. were used. Fresh shell eggs contained on the avg. 10.76 μg. of biotin per egg (225 mμg./g.) with 2.25 mg. (70 mμg./g.) in the white and 8.52 μg. (520 mμg./g.) in the yolk. No loss of biotin occurred during 12 months of cold storage. There was no transfer of biotin between the white and the yolk.—*R. J. Evans.* (Biological Abstracts)

GWIN, J. M. (U. Maryland, College Park.)
QUALITY LOSS IN SHELL EGGS DURING STORAGE. *Amer. Egg and Poultry Rev. 15(3):* 19-20. 1953.—In this concluding article, there are 3 tables showing the quality changes in storage shell eggs. Starting with 75 to 85% top quality eggs at origin, there were only 43 to 53% top quality eggs at the final destination.—*H. G. Lindquist.* (Biological Abstracts)

KRATZER, F. H., D. E. WILLIAMS, ELLY HINREINER, and MARION SIMONE. (U. California, Davis.)
THE EFFECT OF PETROLEUM-BASE HERBICIDES ON GROWTH AND CARCASS FLAVOR IN CHICKENS. *Poultry Sci. 32:* 567-569. 1953.—Approx. 0.1% of a petroleum-base herbicide in the feed of chicks was the lowest level which depressed growth in a series of 3 expts. of 20-25 days' duration. New Hampshire fryers which were fed herbicides at approx. 0.05 and 0.2% levels for 22 days carried no trace of the material in the carcass which would be detected by organoleptic tests.—*F. H. Krazer.* (Biological Abstracts)

McALVEY, K. D., L. E. DAWSON, and J. A. DAVIDSON.
EMMET COUNTY (MICHIGAN) POULTRY MARKETING SURVEY. *Michigan State Coll. Agric. Expt. Sta., Quart Bull. 35(2):* 175-185. 1952. (Biological Abstracts)

NADEN, KENNETH D., and GEORGE A. JACKSON, JR. (U. California, Los Angeles.)
SOME ECONOMIC ASPECTS OF RETAILING CHICKEN MEAT. *Bull. California Agric. Expt. Sta.* 734. 5-129. 1953. (Biological Abstracts)

NILSON, HUGO W. (U.S. Fish and Wildlife Serv., College Park, Md.)
TECHNICAL NOTE NO. 23—FEEDING FISH MEALS AND SOLUBLES TO CHICKENS DOES NOT AFFECT FLAVOR OF MEAT. *Commercial Fish. Rev. 14(12a):* 41-42. 1952.—Meals and condensed fish solubles, all low in oil, produced no distinct off-flavor in the meat of chickens.—*J. L. McHugh.* (Biological Abstracts)

PARNELL, E. D., O. D. BUTLER, SYLVIA COVER, and W. H. SMITH, JR. STORAGE TESTS ON FROZEN FRYERS PACKED WITH AND WITHOUT WATER. *Progr. Rept. Texas Agric. Expt. Sta. 1574.* 1-9. 1953.—The use of ice cream cartons for storage periods as short as 5 mos. allows dehydration (white corky areas) to form in dry packs but not in water packs. Juiciness and flavor of the light meat were somewhat lower in the top water packs than in the dry packs. Packing in 2% salt water seemed to improve flavor of chicken stored only 5 mos. but when either tap or salt water was used in packing, the fryers lost an important amt. of niacin in the thawing liquid.—*Auth. summ.* (Biological Abstracts)

SNYDER, E. S., J. H. L. TRUSCOTT, and E. R. WAYWOOD. (Ontario Agric. Coll., Guelph, Canada.) EXPERIMENTS ON THE FREEZING OF POULTRY. *Poultry Sci. 32:* 383-391. 1953.—193 fowls, mostly Barred Plymouth Rock yearling hens but including some chickens at fryer size, were frozen in various ways and at several temps. Storage temps. of 15, 0 and -10°F. were used and groups of birds examined by a taste panel after periods of 4, 8 and 13 months' storage. All birds were eviscerated and individually packaged in heat-sealed cellophane wraps enclosed in heat-sealed cellophane wrapped individual boxes. Some were cooked prior to freezing, others after storage. Tests of 4 kinds of stuffing were included. Weight loss in storage, increased slightly with time but showed no particular relationship to freezer burn. Nut and sausage stuffings were unpalatable at 4 months' storage, less so at 8 months, and normal or much improved at 13 months. The flesh of the stuffed birds was not affected. There was no palatibility deterioration in the flesh of any bird during 13 months' storage at 0 or 15°F. Chemical tests of fats from the stored fowl showed these fats to be resistant to the chemical changes associated with oxidative rancidity and that these may be relatively high without noticeable effect.—*E. S. Snyder.* (Biological Abstracts)

SWANSON, M. H., and H. J. SLOAN. (U. Minnesota, St. Paul.) SOME PROTEIN CHANGES IN STORED FROZEN POULTRY. *Poultry Sci. 32:* 643-649. 1953.—Ten New Hampshire fowl were dressed and eviscerated and then held at -20.5°C. (-5°F.) for 40 weeks. Samples of breast and leg muscle were taken from each fowl immediately following evisceration and again at 8-week intervals during the storage period. The following detns. were made on each sample: moisture; total N; water soluble N; non-precipitable N; soluble free alpha-amino N; and non-precipitable alpha-amino N. Proteolysis was indicated during frozen storage by increases in soluble N and non-protein N of both leg and breast muscle. Decreases in amino N suggest that certain metabolic processes must be continuing in the frozen state causing further breakdown of the amino acids formed by proteolysis. Although the analysis of variance showed that the observed changes were highly significant, F values also indicated that there was a significant difference among birds in the rate of proteolysis.—*M. H. Swanson.* (Biological Abstracts)

SWICKARD, MARY T., ALICE M. HARKIN, and STANLEY J. MARSDEN. (U.S. Dept. Agric., Washington, D.C.) PALATABILITY OF TURKEYS FED EXPERIMENTAL DIETS CONTAINING AUREOMYCIN AND FISH PRODUCTS. *Poultry Sci. 32:* 726-729. 1953.—As detd. by an experienced tasting panel, the cooked flesh of turkeys fed 10 mg. of aureomycin hydrochloride per kg. of mash starting diet was not statistically different from the cooked flesh of control turkeys in moistness, tenderness, turkey flavor, and absence of off-flavor. Although the general quality of the flesh of all turkeys was rated high, the panel reported some fishy and other off-flavors, particularly in females 16 wks. old. There were few reports of fishiness in males 26 wks. old, possibly because as they grew older they ate less of the mash containing fish products and more of the grain. These turkey-starting diets are too high in fish products for best results in producing highly palatable immature turkeys for the market.—*Authors.* (Biological Abstracts)

MANAGEMENT

CLARK, T. B. (West Virginia Agric. Expt. Sta., Morgantown.)
CANNIBALISM IN POULTRY. *Circ. West Virginia Agric. Expt. Sta. 88.* 3-9 Illus. 1953.—Alleged causes and nutritional and management preventatives of the various forms of cannibalism are discussed. Observations on over 32,000 chicken broilers show that overcrowding in itself does not appear to increase losses from cannibalism. Control measures for turkeys using antipick devices and debeaking are illustrated. Debeaking has been found to be the most reliable control for turkeys grown in confinement.—*Author.* (Biological Abstracts)

MARTIN, G. A., E. W. GLAZENER, and W. L. BLOW. (North Carolina Agric. Expt. Sta., Raleigh.)
EFFICIENCY OF SELECTION FOR BROILER GROWTH AT VARIOUS AGES: *Poultry Sci. 32:* 716-720. 1959.—Live weights of 1238 pedigreed R. I. Red chicks from 71 dams and 24 sires were taken at 3, 6, 9, and 12 weeks. From these data heritability of live wt. at these ages was estimated as approximately .31, .29, .27, and .31, respectively. The best index from this study was secured on the basis of the 6- and 12-week wts. and was estimated to be 0.4% more efficient as a criterion of genetic gain to 12 weeks than was any single wt. However, the slight gain in efficiency does not justify the expense of taking 2 wts. Wt. at 12 weeks showed greater efficiency than any other single wt. Six-week and 9-week wts. appeared to be about 92% as efficient as 12-week wt. Therefore, any wt. taken after 6 weeks should provide an efficient index for selection for genetic gain to 12 weeks.—*Auth. summ.* (Biological Abstracts)

GENERAL

AGCANAS, PABLO B.
THE BARRED PLYMOUTH ROCK CHICKENS. *Philippine Jour. Animal Indust. 12(1/4):* 33-38. 1951.—The observations on the performance of the Barred Plymouth Rock chickens at Alabang Stock Farm are summarized as follows: The dams from which the 12 imported pullets were taken produced from 273 to 327 eggs a year. These eggs weighed from 23.7 to 27.8 oz. per dozen. The 9 imported pullets that completed a year's record produced from 160 to 289 eggs, weighing from 19.76 to 24.24 oz. per dozen. The decrease in production and wt. per dozen of eggs as compared with production of their dams shown in the pedigree, was attributed to climatic condition and age of the birds. The avg. percentage of hatchability from 40 sets was 84.97%. The avg. wt. of the chicks was 42.63 g. The sexual maturity of the F_1 generation was 6 mos. and 28 days.—*Auth. summ.* (Biological Abstracts)

AGCANAS, PABLO B., and TOMAS V. RIGOR.
OBSERVATIONS ON THE IMPORTED S. C. WHITE LEGHORN AND NEW HAMPSHIRE CHICKS UNDER ALABANG CONDITIONS: A PRELIMINARY REPORT.*Philippine Jour. Animal Indust. 12:* 13-17. 1951.—The avg. chick mortality from the 3 shipments was 8.19% in the S. C. White Leghorn and 9.04% in the New Hampshire. The mortality was caused by the number of chicks placed in one chick box from as low as 97 chicks in the S. C. White Leghorn to as high as 109 in the New Hampshire. The avg. mortality in the first 7-day period of their lives for the 3 shipments was 11.72% in the S. C. White Leghorn and 13.89% in the New Hampshire. The "sexed" baby chicks were 98.99% pullets in the S. C. White Leghorn and 99.31% in the New Hampshire. The sexual maturity varied from 4 months and 21 days to 5 months and 27 days in S. C. White Leghorns and from 4 months and 10 days to 6 months and 2 days in the New Hampshires, the avg. being 5 months and 10 days in the S. C. White Leghorns and 5 months and 12 days in the New Hampshires.—*Auth. summ.* (Biological Abstracts)

COLLIAS, N., and M. JOOS.
THE SPECTOGRAPHIC ANALYSIS OF SOUND SIGNALS OF THE DOMESTIC FOWL. *Behaviour 5(3):* 176-189. 1953.—The acoustic spectograph is an instrument permitting a convenient harmonic analysis of sounds (cf. Bell Tel. Syst. Monog. B-1415). The record made, a spectogram, shows distribution in time of the different frequencies of sound in cycles/sec. The spectographic analysis of the call-notes used by a broody hen to attract her chicks (clucking, food-call, roosting call) show essentially brief, repetitive notes of relatively low frequency (in c./sec.). In contrast, the various warning signals made by chickens (hawk warning, ground predator alarm, fear squawk, alerting note, threatening, crowing) are relatively prolonged calls, with emphasis on the higher frequencies. Baby chicks are attracted to a loudspeaker over which brief and low notes from an organ are being played, but are not attracted and may give "distress" calls when prolonged or high tones are played. The "distress" note of a chick is composed of descending frequencies only, whereas ascending frequencies are the prominent component in a pleasure note.—*N. Collias.* (Biological Abstracts)

FUNK, E. M. (U. Missouri, Columbia.)
A REPORT OF THE COURSES OFFERED BY THE DEPARTMENTS OF POULTRY HUSBANDRY IN THE LAND GRANTS COLLEGES LOCATED IN THE UNITED STATES. *Poultry Sci. 32:* 786-787. 1953.—557 separate courses were offered by these institutions divided as follows: Anatomy and Physiology 30; Breeding and Genetics 53; Diseases and Parasites 18; Feeding and Nutrition 59; General Poultry Husbandry or Production 62; Hatchery Management 14; Incubation and Brooding 31; Judging and Selection 43; Management 37; Marketing 51; Miscellaneous Courses 13; Poultry Investigations, Problems, Projects and Study 41; Practical Training and Experience 10; Research 35; Seminar 34 and Turkey and Other Poultry Meat Production 26.—*E. M. Funk.* (Biological Abstracts)

MUMFORD, D. CURTIS.
COSTS AND NET RETURNS IN PRODUCING TURKEY HATCHING EGGS. *Oregon Agric. Expt . Sta. Bull. 524.* 4-48. 1952. (Biological Abstracts)

MUMFORD, D. CURTIS. (Oregon State Coll., Corvallis, Ore.)
COSTS AND NET RETURNS IN PRODUCING TURKEY HATCHING EGGS. *World's Poultry Sci. Jour. 9:* 107-118. 1953.—A formula, using feed cost, farm wages, and the B. A. E. index of prices paid, interest, taxes, and wage rates, is given to calculate the cost of producing a turkey hatching egg. Production costs are itemized for flocks of 4 different size ranges. Feed cost (41%) and depreciation (36%) were the largest cost factors.—*J. B. Christiansen.* (Biological Abstracts

RIGOR, TOMAS V., and MACARIO LIGSAY.
A STUDY OF INCUBATION RECORDS AT ALABANG STOCK FARM. *Philippine Jour. Animal Indust. 12:* 39-44. 1951.—The incubation records for White Leghorns, New Hampshires, Reds and Barred Plymouth Rocks at Alabang Stock Farm were studied. The New Hampshires gave the highest mean monthly percentage fertility; White Leghorns, 2; Rhode Island Reds, 3; and Barred Plymouth Rocks, the lowest. The New Hampshires gave the highest mean monthly percentage of hatchability; White Leghorns, 2d; Rhode Island Reds, 3d; and again Barred Plymouth Rocks, the lowest. The difference in mean percentage fertility between White Leghorns and New Hampshirs is significant, but the difference in mean percentage hatchability is not. The differences in mean monthly percentage of fertility and hatchability between White Leghorns and R. I. Reds: White Leghorns and Barred Plymouth Rocks: New Hampshires and R. I. Reds: and New Hampshires and Barred Plymouth Rocks are significant. The meat type birds, Barred Plymouth Rocks and R. I. Reds exhibited greater variability in the mean monthly fertility and hatchability than the egg type and dual purpose type birds,

the White Leghorns and New Hampshires.—*Auth. summ.* (Biological Abstracts)

TITUS, HARRY W. (Lime Crest Res. Lab., Newton, N. J.)
VARIATION OF EGG PRODUCTION AND HATCHABILITY. *Poultry Sci. 32:* 593-601. 1953.—Data on egg production and hatchability from an uniformity trial conducted at the Agric. Research Center, Beltsville, Maryland, are presented. These data are supplemented with observations made at the Lime Crest Research Lab. between 1946 and 1952. In groups of birds that had not been pre-tested and selected for uniformity, the coeff. of variation of the number of eggs laid per bird varied between 17.5 and 25% and had a typical (or modal) value of 20%. An abnormally large value of this coeff. was obtained in the Beltsville uniformity trial. Also, in flocks that had not been pre-tested and selected for uniformity, the coeff. of variation of percentage hatchability varied between 12.5% and 30%, and had a typical (or modal) value of 20%. The agreement between the value obtained in the Beltsville uniformity trial and the avg. value obtained at the Lime Crest Research Lab. between 1946 and 1952 was good. Estimates were made of the number of untested, unselected birds that would be required to demonstrate that a difference in egg production of 10 eggs when the avg. egg production is 200 eggs, and a difference in percentage hatchability of 5 percent-units when the avg. hatchability is 70%, is statistically significant with odds of 19 to 1 (or at the so-called 5% point). Assuming typical coeffs. of variation, each group should contain not less than 123 birds, in the case of egg production; and not less than 60 birds in the case of percentage hatchability. Assuming the smallest coeffs. likely to be encountered, each group should contain not less than 94 birds, in the case of egg production; and not less than 24 birds, in the case of percentage hatchability—*H. W. Titus.* (Biological Abstracts)

ANONYMOUS.
CHICKENS AND EGGS. MONTHLY EGG PRODUCTION, YOUNG CHICKENS AND LAYERS ON FARMS, AND RATE OF LAY. BY STATES AND GEOGRAPHIC DIVISIONS, 1925-44. REVISED ESTIMATES. *U. S. Dept. Agric. Statist. Bull. 125.* 1-127. 1953. (Biological Abstracts)

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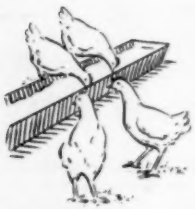

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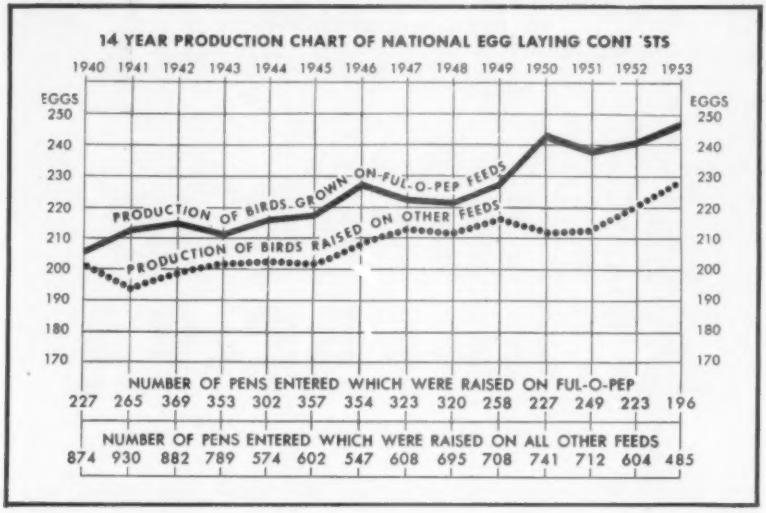
14 YEAR PRODUCTION CHART OF NATIONAL EGG LAYING CONT 'STS
1940 1941 1942 1943 1944 1945 1946 1947 1948 1949 1950 1951 1952 1953
EGGS
250
240
230
220
210
200
190
180
170
PRODUCTION OF BIRDS GROWN ON FUL-O-PEP FEEDS
PRODUCTION OF BIRDS RAISED ON OTHER FEEDS
NUMBER OF PENS ENTERED WHICH WERE RAISED ON FUL-O-PEP
227 265 369 353 302 357 354 323 320 258 227 249 223 196
NUMBER OF PENS ENTERED WHICH WERE RAISED ON ALL OTHER FEEDS
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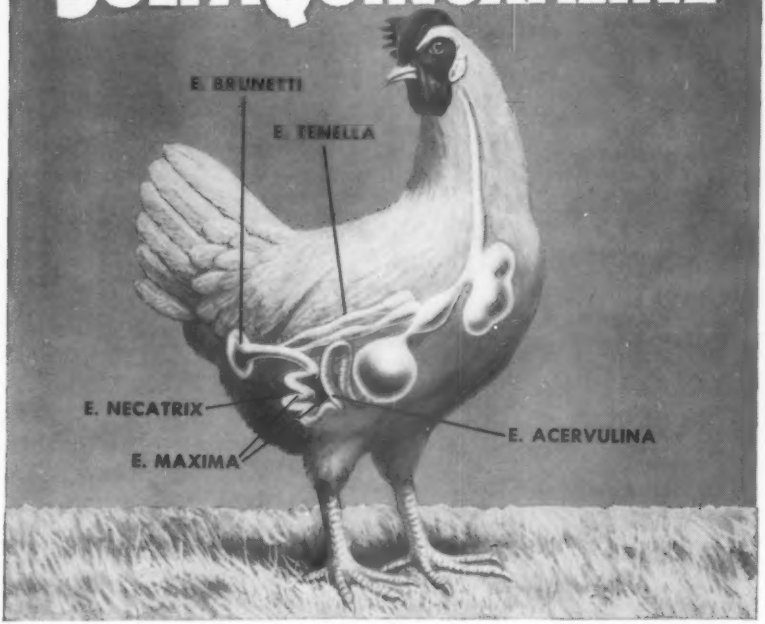

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Chickens need vitamin A for high egg production, good weight gain and feed efficiency, low mortality rate and for general good health. U.S.I. PERMADRY vitamin A spheroids offer feed manufacturers a tested and superior means of vitamin A fortification. This sealed-in form of vitamin A is manufactured under U. S. Patent 2,496,634 and has been shown in experiment station tests to be far more biologically available to poultry than vitamin A from fish oil sources.

B COMPLEX VITAMINS AID GROWTH OF BIRDS

The addition of B complex vitamins to poultry feed increases growth rate and helps produce more uniform, full-fleshed birds — also aids in protein and carbohydrate utilization. U.S.I. supplies riboflavin, calcium pantothenate (dextrorotatory), niacin U.S.P., and choline chloride. Choline chloride is available in 25% dry mix or 70% aqueous solution.

DL-METHIONINE FOR HIGH ENERGY RATIONS

U.S.I. is the pioneer producer of methionine, the low-cost, essential amino acid. Rations that are supplemented with DL-Methionine produce increased return over feed costs and a more rapid growth rate. Methionine is also effective in improving feathering. Your best supply — from U.S.I.

U.S.I. Feed News A Regular Feature

Each month U.S.I. publishes a full page FEED NEWS in the leading publications reaching nutritional and feed formulation specialists. Informative items of interest to all who use feeds and feed supplements are included. Follow this series in U.S. feed publications for new developments in the poultry feeding industry, or send us your name, address and title on your company letterhead to be placed on our mailing list.

FEED PRODUCTS OF U.S.I.

- CURBAY* B-G 80, dried molasses fermentation solubles
- U.S.I. VITAMIN B_{12} AND ANTIBIOTIC FEED SUPPLEMENTS
- U.S.I. CHOLINE CHLORIDE (25% dry or 70% solution)
- U.S.I. MENADIONE MIXES (vitamin K_3)
- U.S.I. RIBOFLAVIN Products
- U.S.I. NIACIN
- U.S.I. CALCIUM PANTOTHENATE Products
- U.S.I. DL-METHIONINE (feed grade)
- U.S.I. VITAMIN A & D Products (stabilized)

*Reg. U.S. Pat. Off.

BRANCHES IN ALL PRINCIPAL CITIES

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Give your birds "teeth"

to grind their feed!

Get faster growth
Cut feeding costs
WITH STONEMO GRANITE GRIT

FOLLOW THESE 3 STEPS TO GROW BIG, STURDY BIRDS!

FINE SIZE STONEMO — First 2 days—Feed fine chick grains and fine-size STONEMO. Mix 10 lbs. grain to 1 lb. grit. 3 days to 4 weeks—Start feeding mash...give fine-size STONEMO in HOPPER-PAK, or hoppers.

MEDIUM SIZE STONEMO — 4 weeks to 8-10 weeks—Gradually switch to medium-size STONEMO—then keep hoppers full.

COARSE SIZE STONEMO — 8-10 weeks on—Switch to coarse-size STONEMO. Then keep it before birds at all times...during growing period and in laying house.

Your birds need "teeth" to help them make better use of their feed...grow faster... reduce your feeding costs! Give them insoluble STONEMO Granite Grit.

HELPS SPEED GROWTH—STONEMO's extra grinding surfaces help grind feed extra fine in the gizzard...crush grains and grasses ...grind open many cellulose "capsules" in feed. This releases *more body-building nutrients* for faster growth and development.

HELPS SAVE FEED DOLLARS—STONEMO helps make your feed work harder...helps produce big, sturdy birds at less cost. You save money—step up profits!

GET STONEMO TODAY!—Put real "teeth" in your feeding program now. Get STONEMO Granite Grit in handy 10-lb. HOPPER-PAKS, or 25, 50 or 80-lb. economy bags. The easy-to-use HOPPER-PAK has trays to pull out to make a convenient hopper. It saves work—saves time! See your hatchery, feed or poultry supply dealer *today*.

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